



INVESTIGATION OF GROUND WATER POLLUTION AT AIR FORCE PLANT NO. 4, FORT WORTH, TEXAS

AD-A197 563



FOR UNITED STATES AIR FORCE OCTOBER 1986

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INVESTIGATION OF GROUND WATER POLLUTION AT AIR FORCE PLANT NO. 4 FORT WORTH, TEXAS

REPORT TO - UNITED STATES AIR FORCE

PREPARED BY U.S. ARMY CORPS OF ENGINEERS
KANSAS CITY DISTRICT
FORT WORTH DISTRICT

OCTOBER 1986

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ABSTRACT

Commencing in December 1982, Hargis and Associates, under a contract with General Dynamics Corporation, conducted an extensive investigation to determine the presence and extent of industrial chemical pollution at Air Force Plant No. 4. A major portion of this work was devoted to the testing of ground water flowing within the overburden. In addition, Harg's had 16 wells drilled to monitor for polluted ground water in the upper and middle zones of the Paluxy Formation. Paluxy ground water was monitored because the Formation is a principal water supply for the contiguous city of White Settlement. Hargis, in a letter to General Dynamics dated 12 April 1985, reported discovery of a concentration of 8,900 ug/l of trichloroethylene, 190 ug/1 of 1,2-trans-dichloroethylene, and lesser amounts of other chlorinated hydrocarbons, and the existence of abnormally high water levels in the upper zone of the Paluxy Formation in well P-8(U). In this letter, and again in the Phase II report of 1985, Hargis interpreted this information to indicate that chemically polluted ground water from the overburden was recharging the upper zone of the Paluxy aquifer beneath the east parking lot of the plant. In early May 1985, the Fort Worth District, Corps of Engineers, operating for Kansas City District Superfund, was asked to review existing data, investigate the distribution of chemical pollution within the Paluxy, and to locate the area in which polluted overburden ground water enters the Paluxy aquifer. The Corps proposed to drill six monitor wells into the upper zone of the Paluxy aquifer and five monitor wells into the alluvium mantling the bedrock, both groups of monitor wells to be located in the east parking lot of the plant. Also, the Corps proposed to have geophysical logs run in Paluxy monitor wells P-1 through P-4, and P-5(M) through P-10(M). These proposals were not implimented because of funding curtailment. The following investigative work was performed at the plant:

Three pairs of Paluxy monitoring wells were drilled along the south boundary of the plant to determine if pollutants discovered in well P-8(U) had reached the south plant boundary. One of each pair of these wells was completed in the upper zone of the Paluxy and the other was completed in the middle zone. Ground water was sampled in these wells and tested by Hargis and Associates. To date <u>none</u> of these wells appear to produce chemically polluted ground water. It is recommended that sampling and testing of ground water from all of the well pairs along the south boundary of the plant continue, preferably on a short-cycle basis. In addition to the drilling of 3 pairs of Paluxy monitoring wells, 28 exploratory borings were drilled in the east parking lot to obtain data for mapping topography of the eroded surface of bedrock in the area where the overburden might be in direct contact with the Paluxy aquifer. Exploratory drilling found that an erosion channel there does not penetrate the Paluxy Formation at any of the drill sites. A

sandstone bed, located immediately beneath the Walnut limestone and separated from the upper zone of the Paluxy aquifer below by 8 to 14 feet of shale, was recognized in geophysical logs of the monitor wells along the southern boundary of the plant, the geophysical log of exploratory boring 8A3F-110, and in short-interval cores in the area of predicted contact between the overburden and the Paluxy Formation, which became known as the "window." This sandstone may be the only member of the Paluxy Formation which becomes polluted in the "window" area. Since this has not been proved, it is recommended that two monitor wells be drilled immediately south of the "window" to test separately this uppermost Paluxy sandstone and the upper zone of the Paluxy aquifer proper. If these wells find pollution to be restricted to the uppermost Paluxy sandstone, it is recommended that additional monitor wells be drilled into the upper zone of the Paluxy aquifer in the vicinity of monitor well P-8(U) to determine whether and to what extent pollution has spread in the upper Paluxy zone proper from well P-8(U). It is also recommended that several monitor wells be completed in the overburden in the east parking lot to better define distribution of polluted ground water and to locate sand and gravel deposits in the erosional channel in the bedrock. Additionally, these wells may offer an opportunity to determine the velocity at which ground water moves through the overburden by injecting a nonhazardous dye tracer in selected wells.

INVESTIGATION OF POLLUTION OF GROUND WATER IN THE PALUXY AQUIFER AT AIR FORCE PLANT NO. 4, FORT WORTH, TEXAS

INTRODUCTION

- Pollution of ground water beneath Air Force Preceding Studies. Plant No. 4 was studied first by Hargis and Montgomery, Inc., then by Hargis and Associates, Inc. The problem being investigated was chemical pollution of ground water within the overburden. Monitoring and testing of ground water commenced with completion of well HM-1 in December 1982. D'Appolonia Waste Management Service conducted a refraction seismic survey in the east parking lot in 1983 in an effort to delineate topography of the eroded top of the bedrock in that area. The U.S. Environmental Protection Agency contracted four wells which were drilled in May and June 1983 to monitor ground water in the overburden. These wells are located in the city of White Settlement near the south and west boundaries of the plant. A record search to locate additional sites of buried industrial waste was made by CH2M Hill Company in 1984. The reader is referred to the following reports for details of other investigations of ground-water pollution at the plant:
 - a. Hargis and Montgomery Inc. 1983a, dated 3 February 1983.
 - b. Hargis and Montgomery, Inc. 1983b, dated 12 July 1983.
 - c. Hargis and Associates, Inc. 1984a, dated 12 October 1984.
 - d. Hargis and Associates, Inc. 1984b, dated 25 October 1984.
 - e. Hargis and Associates, Inc. dated 25 September 1985.

Monitor wells were drilled by Southwestern Laboratories, Inc., of Dallas, Texas for Hargis and Montgomery and Hargis and Associates. Ground water from monitor wells was sampled periodically by Hargis. Ground-water samples were tested for pollutants primarily by Brown and Caldwell Laboratories, Inc., of Bakersfield, California. Some testing was also done by Radian Corporation of Austin, Texas.

Hargis and Associates informed General Dynamics Corporation by a letter dated 12 April 1985, that a concentration of 8,900 ug/l of 190 concentration of trichloroethylene, а 1,2-trans-dichloroethylene and lower concentrations of other chlorinated hydrocarbons had been discovered in well P-8(U) monitoring the upper zone of the Paluxy. In this letter and again in the Phase II report of 25 September 1985, Hargis interpreted abnormally high water levels in well P-8(U) and normal water levels in well P-8(M) coupled with finding pollutants in the upper zone of the Paluxy to indicate that ground water from the overburden was probably recharging the upper portion of the Paluxy aquifer in an area east of the Assembly Building where the normally intervening Walnut Formation was believed to be missing. At the beginning of May 1985 the Air Force asked the Corps of Engineers to assist in determining the extent of pollution within the Paluxy Formation beneath the east parking lot in the vicinity of the Paluxy monitor well P-8(U) and to employ contractors to do remedial work if immediate action was required.

- Scope and Objectives. The Corps of Engineers was to review all 2. accumulated data bearing on pollution of the Paluxy Formation in the southeast part of the plant property. The Corps was then to develop a plan of investigation with the object of defining the limits of pollution within the Paluxy discovered by monitor well P-8(U) and to drill a number of exploratory borings to locate the area in which pollutants enter the Paluxy. The Corps plan included drilling and completing three pairs of Paluxy monitor wells along the southern boundary of the plant to discover if pollutants were present and moving beyond the south plant boundary toward the city of White Settlement. The Corps of Engineers proposed that an additional six monitor wells be drilled and completed in the upper zone of the Paluxy aquifer to aid in defining the pollution plume. The area in which pollutants were believed to enter the Paluxy Formation was to be investigated by the drilling of 20 exploratory borings which would also define bedrock topography. Additionally, five monitor wells were to be completed in the overburden in the east parking lot. Monitor wells P-1 through P-4 and middle Paluxy wells P-5(M) through P-10(M) were to have their pumps pulled and to have geophysical logs run in them to better resolve bedrock stratigrapy. Because of funding curtailment, the Corps drilled only 3 pairs of monitor wells along the south boundary of the plant and 28 exploratory borings in the east parking lot.
- 3. Local Geology. Air Force Plant No. 4, operated by General Dynamics

Corporation, Fort Worth Division, is situated on overburden immediately beneath which is a sequence of bedrock formations comprised of limestone, shale, and soft sandstone, all of Cretaceous age. The deepest of these formations which are relevant to this investigation is the Glen Rose Formation consisting principally of limestone. Depth of the Glen Rose limestone varies within the plant area from 213 feet in well P-1 to 236 feet in exploratory boring 8A3F-110. Above the Glen Rose, in ascending order, are the Paluxy Formation, the Walnut Formation, and the Goodland Formation.

a. Stratigraphy.

of sandstone which varies from nearly uncemented sand to moderately cemented sandstone. The formation also contains a number of shale beds, most of which range from a thickness of less than 1 foot to as much as 5 feet. The top of the Paluxy Formation is defined as the first sandstone encountered beneath shale or limestone of the overlying Walnut Formation. The Paluxy has been divided into three zones. The lower zone, immediately overlying the Glen Rose Formation, is comprised of a number of sandstone beds separated from each other by beds of shale from less than 1 foot thick to as much as 7 feet thick. Two geophysical logs of this zone in the city of White Settlement indicate that much of the sandstone is somewhat shaly or clayey. The zone is quite consistent in total thickness throughout the plant/White settlement area. Because of

the presence of beds of shale and shaly sandstone, the lower zone of the Paluxy probably contributes less ground water to water supply wells within the city of White Settlement than does the middle zone.

The middle zone of the Paluxy has a relatively small shale or clay content. This unit is the uppermost Paluxy unit in which White Settlement city wells are completed. The middle zone of the Paluxy Formation is quite recognizable on geophysical logs of wells in this area. For examples of this see Plate 1 which is a correlation diagram in the plant/White Settlement area utilizing geophysical logs.

Water wells producing from the Paluxy Formation in the city of White Settlement are not completed in the upper zone of the Paluxy because of its low productivity. The upper zone of the Paluxy varies in composition significantly more in the proportion of sandstone and shale which comprise this zone in the area of Plant No. 4 and the city of White Settlement than does either the middle or the lower zone. In White Settlement, well No. 8, 19 feet of Walnut shale separates the Walnut limestone and the Paluxy sandstone. Only 0.5 to 1.5 feet of shale separates these beds in the plant area. The upper Paluxy zone is comprised of individual sandstone beds and of sub-zonal units consisting of a number of sandstone beds. The sub-zonal units are separated from each other by shale beds. These sandstone units vary in thickness from about 13 feet to 20 feet. Individual sandstone beds vary from a thickness of about 1 foot to as much as 8 feet.

- Walnut Pormation. Regionally the Walnut Formation is (2) comprised principally of shale which has a medial shelly limestone This member is the Walnut limestone described in earlier member. reports of investigation at the plant. The medial limestone member of the Walnut is approximately 30 feet thick in the plant/White Settlement area. Any shale present separating this member from the first Paluxy sandstone below is classified as belonging to the Walnut Formacion. The Walnut also has a shale member overlying the Walnut limestone in this area which is approximately 20 feet thick. This shale has, on rare occasions, been classified as belonging to the Goodland limestone Formation above it, but regionally it belongs to the Walnut Formation. This shale contains a few feet of impure limestone in its middle This part of the Walnut Formation can be seen on the portion. geophysical and strip-log of White Settlement well No. 8 on Plate 1.
- (3) Goodland Formation. The Goodland Formation overlies the Walnut shale. It is composed of limestone containing a few thin shale beds. Its total thickness is approximately 80 feet near the plant. Only a few feet of the basal part of the formation are present in the bedrock sequence beneath the plant because of erosion of its outcrop. Limestone comprising this formation is present beneath the plant only where the overburden is thin and bedrock is relatively near the surface. These conditions prevail mainly along the southern boundary of the plant property.

- (4) Overburden. Alluvium mantling the eroded surface of bedrock beneath the plant has been called the upper zone in reports by Hargis and Montgomery, Inc., and by Hargis and Associates, Inc. This material is referred to here as overburden. Overburden in this immediate area consists primarily of clay, some of which is sandy and gravelly, but it contains channel deposits of sand and gravel as well.
- b. Structure. Geologic structure in the shallow Cretaceous bedrock above the top of the Glen Rose Formation consists principally of gentle regional dip slightly south of east at approximately 30 feet per mile. Formational dip places the base of the Walnut limestone at between elevation 582 and elevation 587 along Grants Lane and at elevation 600 to elevation 602 in the vicinity of monitor wells P-10(U) and P-10(M) near the unnamed creek west of Bomber/Meandering Road west of the plant.

c. Aquifer Bydrology.

(1) Overburden. Ground water within the overburden flows in two general directions on top of the eroded bedrock in the plant area. A divide area of relatively high bedrock extends approximately north-south in the general area of the Parts Plant Building (No. 5) northward from about the location of Warehouse No. 1. West of this subsurface divide, overburden ground water flows toward the unnamed creek west of Bomber Road. East of the divide, ground water flows to the east, then to the north, down at least two buried channels eroded into the top of the bedrock.

(2) Paluxy Upper Zone. Many water levels in wells completed in both the upper and middle zones of the Paluxy aquifer are at elevations below the top of the upper zone of the aquifer. In wells P-8(U) and P-10(U) completed in the upper zone, early water levels were 19 and 21 feet higher than water levels in their companion wells P-8(M) and P-10(M) completed in the middle zone of the Paluxy, suggesting recharge of the upper zone of the Paluxy aquifer in the vicinity of the wells. Contours on elevations of water levels in monitor wells completed in the upper zone of the Paluxy aquifer are shown on Plate 2. The contours are drawn on few data. These piezometric data are not well distributed for purposes of hydrologic interpretation. However, it is known that the upper zone of the Paluxy aquifer is recharged through outcrops of this zone in the bottom of Lake Worth, immediately north of the plant where the lake is oriented east-west. Contours in areas of closest well data suggest that ground water in this zone probably flows nearly due south, except for anomalies. Contours around well P-10(U) have been drawn to suggest that recharge may be occurring in the bottom of the unnamed creek west of Bomber/Meandering Road. This was done because of the anomalously high water level in well P-10(U) next to the creek. Anomalously high water levels in the upper zone of the Paluxy in well P-8(U) coupled with the discovery of chemical pollution in water from Paluxy monitor well P-8(U) and water from overburden monitor wells such as HM-82 gave rise to Hargis' interpretation that overburden ground

water containing chemical pollution was in hydraulic contact with the upper zone of the Paluxy Formation and was actively recharging the upper zone of the Paluxy aquifer. That part of the channel eroded into the bedrock in which contact between the overburden and sandstone of the Paluxy aquifer was believed to exist has been called the "window." The "window" was believed to be located under the east parking lot of the plant, southeast of Engineering Building 200.

(3) Paluxy Middle Zone. Plate 3 shows contours on elevations of water levels in the middle zone of the Paluxy aquifer. Water level contours from the relatively few monitor well data in the middle zone of the Paluxy as drawn suggest a flow direction of south 30° east in this The water level elevation data contour smoothly, and 5 foot contours are more widely separated than are those of the upper zone of the Paluxy aquifer. These conditions suggest that the middle zone here may be more remote from its source of recharge than is the upper zone. The flow direction indicated by the contours seems to indicate that the recharge area of the middle zone is farther upstream in Lake Worth than is that of the upper zone. This appears to be in accord with regional structure of the Paluxy Formation. Since the Paluxy Formation dips (inclines) eastwardly, it also rises to the west. The middle zone of the formation is not known to crop out in the bottom of Lake Worth along the north boundary of the plant. It may crop out in the lake bottom north and west of the plant.

PLAN OF INVESTIGATION

- 1. Paluxy Monitor Well Program. Initial action by the Corps of Engineers was to drill and complete three pairs of monitor wells on an east-west line along the south plant boundary. The well pairs were located 500 feet apart. Wells P-11(U) and P-11(M) were completed in the middle of the south end of the east parking lot. Wells P-12(U) and P-12(M) were located in the alley along the south side of General Warehouse Building No. 188. The well heads were placed in small concrete vaults beneath the alley paving. The vaults were covered by removable steel cover plates to permit vehicle traffic, yet easy access to the well heads and protection from entry of rain runoff into the wells. Wells P-13(U) and P-13(M) were completed 80 to 90 feet south of the line of P-11 and P-12 well pairs. P-13(U) and P-13(M) are located just off the concrete apron approximately 120 feet south of the southwest corner of Run Station No. 1. Zonation of the Paluxy Formation used for completion of these wells was tailored to match that employed by Hargis and Associates. purpose of the well pairs was to discover if pollution within the Paluxy aquifer had reached the south boundary of the plant in the upper or middle zones of the Paluxy.
- a. Well Drilling and Construction. Well drilling and completion procedures employed were similar to those used by Southwestern Laboratories in their work for Hargis and Associates. Of the three wells completed in the upper zone of the Paluxy along the southern

boundary of the plant, only well P-12(U) was completed to include the uppermost sandstone immediately beneath the Walnut limestone. casing program used for completions in the upper zone of the Paluxy involved steel casing through the Walnut limestone. However, only a 14-inch diameter hole was drilled in this section into which 10-inch steel casing was set, centralized, and cemented from the bottom of the casing to the ground surface. A 9-7/8-inch diameter hole was then drilled from the bottom of the 10-inch casing to total depth of the well into which was set 4-inch centralized, schedule 80 PVC casing, at the bottom of which was 20 feet of 4-inch I.D., 0.010 slot PVC well screen, plugged at the bottom. Filter sand was placed in the annulus around the 4-inch casing, extending upward into the steel casing. A 2-HP, 8 gpm, 2-7/8-inch diameter, 20 stage, single phase, Model 2x4 P050 submersible pump, manufactured by the Standard Pump Company of Bartlesville, Oklahoma, was installed in each well for water sampling. A 14-inch hole was drilled through the upper zone of the Paluxy into the uppermost part of the middle zone of the Paluxy and cemented to the surface in wells completed in the middle zone. As in wells completed in the upper zone, a 4-inch PVC casing and 20 feet of 4-inch PVC screen was set and sand packed in the test interval of the middle zone. The same model submersible pump was installed in all wells, regardless of the zone they were completed in.

A black substance was encountered while drilling cement remaining in

the 10-inch casing of well P-13(M) after the casing cement had set. It was found to be gilsonite, a powdered material used to prevent lost circulation while cementing. It was not known if this material had been incorporated in cement behind the casing, but this circumstance was assumed as a "worst case." Samples of this material, recovered during drilling cement in the casing, were analyzed by Southwestern Division Laboratory of the Corps of Engineers in Dallas, Texas, to determine if any toxic substances were present. Additional samples of this material were obtained from the Western Company of North America, the well cementers, and were sent to Hargis and Associates to be exposed to dissolution by a solution of trichloroethylene (TCE) in a concentration similar to that discovered in ground water from well P-8(U). Tests were run to determine first, whether the gilsonite would go into solution; and second, whether any toxic substances would be produced in the process of dissolution. Test results from both laboratories were negative, allowing further operations in the well. Incorporation of gilsonite in the casing cement also raised a question as to the integrity of the casing cement. Western Company of North America pressure tested the well with water under 200 psi and then retreated the well with an additional 75 sacks of neat cement slurry with a surface pressure of 150 psi at their expense. Logging of the Paluxy monitor well pairs was done initially from drill cuttings, as were Paluxy wells P-1 through P-10. In addition, an electric log was run in the open hole

(before setting 4-inch PVC casing) and a gamma ray log was run through the entire hole to produce a log which included the portion of the well where steel casing was set. Though the commercial logs run in the first wells drilled, P-11(U) and P-11(M), were of poor quality, it became obvious very soon that the logs made from drill cuttings from beds below the base of the Walnut limestone did not agree well with the electric and gamma ray logs of the same section of bedrock. A variety of reasons account for this, most of which are related to the soft nature of the bedrock which, when drilled, would break sandstone down to sand grains instead of sandstone chips, and shale into discolored drilling fluid instead of shale chips of sufficient size for recognition. Because of the difficulty in obtaining good logs from drill cuttings, considerable reliance was placed on geophysical logs of the Paluxy monitor wells along the southern property line of the plant. The most desirable features of geophysical logs, compared with drill cutting logs, are the greater degree of resolution of individual beds and small units and the curve character which results in characteristic signatures of each formation, aiding correlation. All of the Paluxy monitor wells were developed by airlift pumping and surging. Each well was pumped by airlift, followed by a brief lowering of the air supply line below the eductor pipe to blow the well with compressed air, followed by an immediate return to airlift pumping. This cyclic activity was repeated every 15 minutes for a total development period of 4 hours.

Well Water Sampling and Testing. All sampling and testing of

ground water from Paluxy wells P-11(U) and (M), P-12(U) and (M), and P-13(U and M), was done by Hargis and Associates as part of their continuing program of ground water monitoring. Table 1 lists tests which found pollutants. Other unpolluted tests are included to indicate changes where pollution disappeared. Reproductions of test reports are located in the Appendix at the end of this report. The finding of methylene chloride and toluene in water samples from Paluxy monitor well P-11(U) followed by a 6-month period of unpolluted tests is interpreted to mean that the upper zone is probably unpolluted. Tests of water samples from well P-11(M) have contained no pollutants to date indicating that the middle zone of the Paluxy probably is unpolluted at the site of well P-11(M). Tests of water from well P-12(U) found oil and grease on 12 December 1985 and again on 9 January 1986. This material probably was present only in limited amounts because subsequently it disappeared from tests of water from the well. It may have come from the rig that drilled well P-12(U). 0n 9 January 1986, 62 ug/1 1,1,1-trichloroethane was found in P-12(U). This pollutant was found again in concentration of 56 ug/1 on 6 April 1986. The same pollutant was found on 9 July 1986, but in a concentration of only 7 ug/1. trend of diminishing concentrations of 1,1,1-trichloroethane suggestive that the upper zone of the Paluxy is unpolluted, and that this chemical may have been introduced during drilling. The presence of only one contaminant is considered unusual. Generally two or more

TABLE 1
TEST RESULTS

	Test Date or Receiving	
Well No.	Date	Concentration Pollutant
P-11(U)	9-05-85	15 ug/l Methylene
		Chloride
	9-05-85	64 ug/l Toluene
	10-10-85	70 ug/l Toluene
	1-08-86	Purgeable Priority Pollutants - all below
		detection level.
	4-05-86	Same
	7-10-86	Same
P-11(M)	No pollutants	detected between 8-29-85 and 7-22-86.
P-12(U)	12-12-85	32 mg/l Oil and Grease
	12-12-85	Purgeable Priority Pollutants - all below
		detection level.
	1-09-86	9 mg/l Oil and Grease
	1-09-86	62 ug/l l,l,l-Trichloro-
		ethane
	4-06-86	56 ug/l l,l,l-Trichloro-
		. ethane
•	7-09-86	7 ug/1 l,l,1-Trichloro-
•		ethane
P-12(M)	10-10-85	First Purseehla Priority Pollution tost - 11
F-12(H)	10-10-03	First Purgeable Priority Pollution test - all below detection level.
	7-09-86	5 ug/1 1,1,1-Trichloro-
	7 07 00	ethane
	7-09-86	2 ug/l 1-1-Dichloroethane
P-13(U)	4-09-86	First Purgeable Priority Pollutant test - all
		below detection level.
	5-07-86	0.17 mg/l lead - 0.12 mg/l above
	r 03 04	maximum permissible concentration
	5-07-86	0.06 mg/l - Manganese - 0.01 mg.1
		above maximum permissible concen-
	5-08-86	tration.
		8 ug/l Methylene Chloride
•	6-05-86	0.06 mg/l lead - 0.01 above maxi-
	6-05-86	mum permissible concentration
	0-03-00	Purgeable Priority Pollutants - all below detection level.
	7-09-86	
	7-03-00	Purgeable Priority Pollutants - all below detection level.
P-13(M)	8-06-86	Tests for oil and grease and for total fuel. Hyd
		carbons - all below detection level.
	8-06-86	Purgeable Priority Pollutants - all below detecti
		level.
	8-06-86	B/NA Priority Pollutants - all below detection
	0-00-00	1 and

level.

contaminants are found when an aquifer is polluted. This well should continue to be sampled and tested to build a larger body of test data. Well P-12(M) produced water with only 5 ug/l of 1,1,1-trichloroethane and 2 ug/l of 1,1-dichloroethane on 9 July 1986. Since water from this well has only been sampled and tested once, no conclusion can be reached concerning pollution of the middle zone at the location of the well. This well should continue to be tested to build a body of test data. Only minor concentrations of pollutants have been found in water samples from well P-13(U) to date. Traces of lead and manganese and a low concentration of methylene chloride, found during the initial 3-month period of testing, does not suggest that the upper zone of the Paluxy is polluted at the location of the well. This well should continue to be monitored. Sampling and testing of well P-13(M) so far indicates that no pollutants are present in the middle Paluxy here. Ground water from this well should continue to be sampled and tested.

A test of interzonal communication was conducted in the Paluxy wells P-12(U) and P-12(M). The middle zone was continuously pumped at 8 gpm in well P-12(M) for a period of 3 hours. Water levels were measured in well P-12(U) throughout this period. No drop in water level of P-12(U) was experienced during the test period. Though this test suggests lack of communication between the upper and middle zones of the Paluxy aquifer at this location, the test is not considered to be conclusive. Only unchanging water levels, measured in well P-12(U) during pumping of

well P-12(M) at a much greater rate, sustained over a much longer period, can reasonably demonstrate lack of communication between the upper and middle zones of the Paluxy Formation.

c. <u>Safety Procedures</u>. Hazards to drilling personnel were assessed at the beginning of field operations. It was determined that risk was at EPA Level D (minimal). Optional rubber gloves were used by drilling personnel where needed in addition to other protective clothing specified for Level D risk.

The Failing 1500 drill and all tools used in drilling the Paluxy monitor wells were steam cleaned after completing each well. drilling fluids and cuttings, including augered materials, were collected and segregated in containers specifically for this purpose. The collected materials were sampled, and the samples were tested for the presence of purgeable priority pollutants. Results of these tests determined whether or not the materials required disposal in a toxic waste dump. The collected materials were turned over to General Dynamics Corporation for disposal based on test documentation supplied at the material transfer. Initially, collected surplus drilling materials were tested for volatile organic compounds as a slurry with a gas chromatograph using EPA Method 601. Subsequently, all materials were tested by gas chromatography/mass spectrometry by EPA Method 624 which tests for a greater range of compounds. Nearly all of the materials removed from the exploratory borings were products of

augering. Since no permanent installation was made in these borings, these materials were used to backfill the holes. Any surplus was collected, tested, and disposed of as were materials derived from drilling wells.

- 2. "Window" Investigation. The site of the erosion channel in which the "window," as interpreted by Hargis and Associates, was believed to exist, is the east parking lot primarily in an area near Grants Lane, southeast of Engineering Building 200.
- a. <u>Drilling Plan and Procedures</u>. A plan of boring and section locations is shown on P'ate 4. The drilling program designed to discover the location of the "window" was one of obtaining subsurface topographic data on the top of bedrock in the area of the east parking lot. Data on lithology of the uppermost bedrock were obtained as an integral part of the drilling. Drilling of borings 8A4C-83 through 8A4C-86 early in the investigation, before the drilling of Paluxy wells was well advanced, proved inconclusive in finding the "window" which is the location where overburden alluvium is in contact with sandstone of the Paluxy aquifer. Borings 8A4C-84 through 8A4C-86 found bedrock to be comprised of Walnut limestone, the top of which was at about the same elevation in all three borings. Drilling of exploratory borings was resumed after completion of all Paluxy monitor wells but P-13(M). This effort took the form of laying out four rows of potential exploratory boring locations from which to select those for drilling based on

The rows of locations were laid out east-west. parallel to station lines of the plant survey grid. Drilling results from each row were portrayed as geologic sections on plates 6 and 7. Borings at the east end of each row, plus other borings near the eastern boundary of the east parking lot, formed an additional row and were used to construct geologic Section E-E', shown on plate 8. As drilling proceded on rows D-D' and E-E', additional borings were drilled between the first borings to reduce the risk of failing to encounter any erosional channel in the bedrock which might penetrate the Paluxy Formation and constitute a "window" through which polluted ground water from the overburden might enter the Paluxy aquifer. One boring, 8A3F-110, was drilled and logged geophysically to obtain stratigraphic information on the basal Walnut limestone and the whole of the Paluxy formation beneath the Walnut. See Plate 4 for locations of monitor wells, exploratory borings, and geologic sections in the southeastern portion of the plant..

b. Drilling Results.

- (1) Overburden Composition. Alluvium comprising the overburden consists of clay, sand, and gravel with some of these materials of somewhat mixed composition. The materials are shown on Sections A-A' through E-E' on Plates 6 through 8, and on logs of all wells and exploratory borings located in the Appendix at the back of this report.
 - (2) Bedrock Brosional Topography. Topography of the eroded top

of the bedrock is shown in plan on Plate 5, and in section on Plates 6, 7, and 8. Bedrock topography of direct concern to the site of a "window" is that of an erosional channel in the bedrock commencing near the south end of Warehouse No. 12. The channel extends eastward and "downstream" under Process Building No. 181, Materials Storage Building No. 182 to the northwest corner of General Warehouse Building No. 188 where it turns to the northeast. From Building No. 188 the channel extends across the east parking lot to the site of plugged overburden well HM-67, adjacent to Grants Lane and west of Field Operations support Building No. 189. Data from exploratory borings drilled in this investigation and from foundation borings drilled for plant construction suggest that a relatively flat bedrock exists between boring 8A-105 and Engineering Building No. 200, which includes the area beneath the Field Operations Building and Grants Lane. Elevations of the bedrock here range from 585 to 590. Any deeper erosional channel that may exist, eroded into this relatively flat area, may take a course similar to that suggested by the 595-foot contour on Plate 5.

(3) <u>Bedrock Stratigraphy</u>. The stratigraphic sequence of the lower portion of the Walnut formation and the uppermost portion of the Paluxy Formation is shown on Sections A-A' through E-E' on Plates 6, 7, and 8. Stratigraphy of these formations in the form of five geophysical logs with strip logs showing rock types is also shown on Plate 1, which is a bed.ock correlation diagram. Wells numbered H-4 and 8, shown on

Plate 1, are located in the city of White Settlement. Also shown on Plate 1 are monitor wells P-12(M) and P-13(M), which are located along the south boundary of the plant. Stratigraphic boring 8A3F-110, on the right side of Plate 1, is north of monitor wells P-8(U) and P-8(M) in the east parking lot. See Plate 4 for the location of monitor wells and exploratory borings.

Good samples of the uppermost sandstone of the Paluxy Formation, which occurs imediately beneath the Walnut limestone, were obtained by short-interval coring of exploratory borings 8A4C-102 and 8A4C-103. (These borings are shown on Sections D-D', Plate 7, and E-E', Plate 8). Core of the uppermost sandstone was found to be very fine-grained and probably silty. Permeability of this core was not tested, but based on visual appearance, the sandstone has low permeability for a sandstone. Likewise, core of 2.4 feet of the top of the Paluxy aquifer proper from exploratory boring 8A4C-102, and core of the upper part of the upper zone of the Paluxy formation in monitor well P-13(M) was also fine-grained and apparently has low permeability. A gradual downward trend of increasing coarseness of the sandstone of the upper zone of the Paluxy was observed in core from well P-13(M). Boring 8A4C-102 in Section D-D', shows the shallow bedrock sequence logged from 4-inch core. It is to be noted that the log of plugged well HM-67, shown in this section, indicates a unit entirely of shaly clay/claystone. This description is not one normally applied to overburden in this area.

Such a description may indicate either a channel filled with clay, developed during deposition of the Paluxy Formation, or more likely difficult logging of drill cuttings. Section E-E' contains a log of boring 8A4C-103 which shows 3.5 feet of clay shale overlying the basal 1.1 feet of the Walnut limestone. It is unlikely that this material is part of the bedrock and is not shown to be as this portion of the Walnut Formation consists entirely of limestone. It may be that this material is stream-transported, weathered shale which came from bank-sloughing either upslope or upstream. The logging of approximately 9.6 feet of clayey shale in the bottom of well HM-71, shown on Section E-E' on Plate 8, is questioned. Again, this material is in the position normally occupied by the Walnut limestone in this area. The descriptive name "clay shale" is not one which is normally applied to alluvium in this area.

In almost all of the exploratory borings and monitor wells in and near the east parking lot of the plant, the first bedrock encountered is limestone which belongs to the Walnut or Goodland Formations. The base of the Walnut limestone is shown on the geologic Sections B-B', C-C', D-D', and E-E' (Plates 6 through 8). The sources of data on this stratigraphic horizon are exploratory borings 8A4C-85, 8A4C-102, 8A4C-103, 8A3F-110, and monitor wells P-2, P-9(M), and well pairs P-6, P-7, and P-11.

The logs shown on Plate 1 indicate that at least 50 percent of the

uppermost 14 to 18 feet of the Paluxy Formation is comprised of shale, the remainder of which is comprised of sandstone. The stratigraphic sequence in this portion of the Paluxy, downward from the base of the Walnut limestone, is as follows: 0.5 to 1.5 feet of shale; 2.6 to 8.0 feet of Paluxy sandstone; and 8.0 to 13.8 feet of Paluxy shale. Thicknesses of these units show the major variations to be expected in the area between well H-4 in the city of White Settlement and boring 8A3F-110 in the east parking lot of the plant. The upper zone of the Paluxy aquifer proper commences beneath the last shale listed above. Logs shown on Plate 1 also indicate that individual lithologic members comprising the uppermost 14 to 18 feet of the Paluxy Formation probably persist throughout the area encompased by the well/boring logs. most prominent lithologic variation in this part of the Paluxy, shown on Plate 1, is the pinchout of the uppermost sandstone between well H-4 and well number 8 in the city of White Settlement. Core from exploratory borings 8A4C-102 and 8A4C-103, shown on Plate 7, confirm stratigraphic sequence interpreted from the geophysical logs.

Monitor wells P-8(U) and P-8(M) are located in the east parking lot between the line of monitor well pairs P-11, P-12, and P-13, and exploratory borings 8A3F-110 and 8A4C-102. Existence of the consistent stratigraphic section in the uppermost Paluxy in these wells and borings suggests that the shale member separating the uppermost Paluxy sandstone from the upper zone of the Paluxy aquifer proper below probably was not

seen and logged in drill cuttings from P-8(U) and P-8(M).

That portion of Section D-D' on Plate 7 between exploratory boring 8A4C-102 and monitor well HM-67, and the portion of Section E-E' on Plate 8 between exploratory borings 8A-105 and 8A4C-85 show the lowest elevations of the channel. This is the area where the "window" was believed to be located. None of the exploratory borings in the area found the erosion channel to penetrate the Paluxy Formation. In all borings but plugged monitor well HM-67 lithology of the channel bottom is Walnut limestone. However, only 1.1 feet of Walnut limestone was present in boring 8A4C-103. The correlation line depicting the base of the Walnut limestone between well P-9(M) and boring 8A4C-102 on Section D-D' (Plate 7), indicates that the Walnut limestone probably is only 1-foot thick at the location of boring 8A-107. The drill cutting log of monitor well HM-67 (Sections D-D' and E-E') suggests that no Walnut limestone is present above the Paluxy Formation at the location of the well.

(4) Bedrock Hydrology. No hydrostatic data were collected from the Paluxy Formation during the drilling of exploratory borings in the east parking lot due to funding curtailment. The six monitor wells, which were to have been completed in the upper zone of the Paluxy, and five monitor wells, which were to have been drilled in the "window" area were expected to define the hydrologic relationship between the overburden and the Paluxy aquifer in this area. Though the desired

hydrologic data were not obtained, possible hydrologic conditions in the "window" area are interpreted from stratigraphic relationships described in the preceding Section 3, Bedrock Stratigraphy. Hydrologic interpretations are made here because: (1) hydrologic conditions in the "window" are pertinent to determining how much thickness of the Paluxy Formation contains polluted ground water and; (2) these interpretations form the basis for a recommendation for future action which appears at the end of this report.

None of the exploratory borings in the east parking lot found the channel located there to have been eroded deeply enough into the bedrock to have penetrated the Paluxy Formation. However, the 1+ foot of Walnut limestone at exploratory boring locations in the relatively flat area comprising the bottom of the channel north of boring 8A-105 (Plates 5 and 8) is missing in monitor well HM-67. It is considered likely that erosion has caused the channel to be incised as much as 5 to 10 feet into the Paluxy sequence of beds in the flat-bottomed area of the "window" near Grants Lane, north of monitor well HM-67, penetrating the uppermost Paluxy sandstone. It is doubted that the channel is eroded as deeply as 15 feet into the Paluxy Formation in the "window" area, which would reach the top of the sandstone of the Paluxy aquifer proper and allow entry of polluted overburden water into the aquifer.

If the channel penetrates the uppermost Paluxy sandstone in the "window" north of the area explored as anticipated, the sandstone will probably be charged with polluted ground water from the overburden. If

the channel does not penetrate the upper zone of the Paluxy aquifer proper, the aquifer should be free of pollution. Since the top of the test interval of monitor well P-8(U) is at the base of the Walnut limestone, the test interval hydraulically connects the uppermost sandstone with the upper zone of the Paluxy aquifer. Connecting these two units renders uncertain the meaning of any water level measured in the well. Given presently available data, it appears possible that only the uppermost Paluxy sandstone in the east parking lot area is recharged with polluted ground water originating in the overburden. This ground water is believed to be entering monitor well P-8(U), causing high water levels. It is also believed that this ground water descends in the well and enters the upper zone of the Paluxy aquifer. The speculations just presented have not yet been proved by the construction and testing of requisite monitor wells. If the conditions suggested prove to be correct, it should be possible to establish that only the uppermost Paluxy sandstone contains polluted ground water and that the upper and middle zones of the Paluxy aquifer are not in danger of being polluted in all of the east parking lot but the area immediately around monitor well P-8(U).

CONCLUSIONS

1. Alluvial overburden was not found to be in contact with the uppermost sandstone of the Paluxy Formation or with sandstone beds comprising the upper zone of the Paluxy aquifer proper in any well or exploratory boring drilled in this investigation. However, only a

minimum of approximately 1 foot of limestone and 0.5 foot of shale separates the overburden and the uppermost Paluxy sandstone in the "window" area.

2. The uppermost sandstone of the Paluxy Formation is separated from the upper zone of the Paluxy aquifer proper, which underlies it by 8 to 14 feet of shale in all wells and exploratory borings which have been logged geophysically or have been cored through this stratigraphic interval in the east parking lot of the plant and in water supply well H-4 in the city of White Settlement.

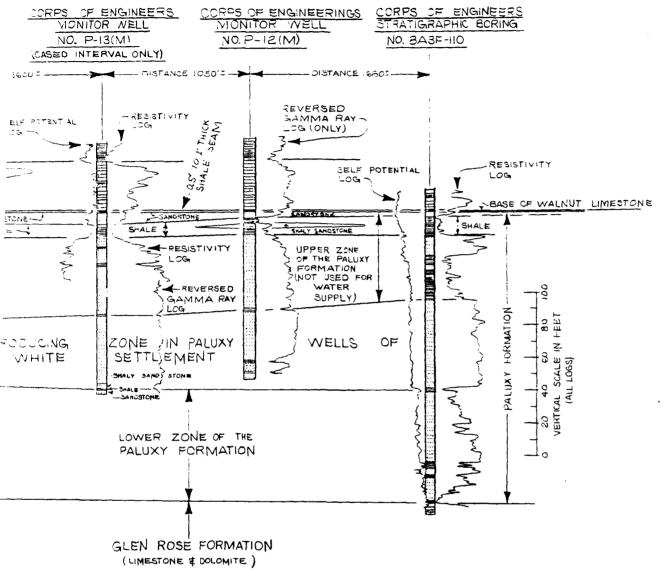
RECOMMENDATIONS

- 1. It is recommended that ground water from Paluxy monitor wells P-11(U), P-11(M), P-12(U), P-12(M), P-13(U), and P-13(M), continue to be sampled and tested for the presence of pollutants, preferably on a short-cycle basis.
- 2. It is recommended that two monitor wells be drilled to test separately the uppermost sandstone bed and the upper zone of the Paluxy aquifer proper. These wells should be located just outside the south edge of the "window" area so that at least 5 feet of Walnut limestone will be present in which to set steel casing, better isolating the test interval from the overburden above. The intent of this recommendation is to determine whether pollution is limited to ground water in the uppermost sandstone unit of the Paluxy Formation.
- 3. If pollution proves to be confined to the uppermost Paluxy sandstone by drilling and testing the recommended wells, it is further recommended

that additional monitor wells be completed in the upper zone of the Paluxy aquifer in the vicinity of existing monitor well P-8(U) to determine whether and to what extent pollution has spread from that well in the upper Paluxy aquifer proper.

4. It is also recommended that several monitor wells, completed in the overburden, be drilled in the east parking lot to better define the distribution of polluted ground water and to locate sand and gravel deposits in the erosional channel in the bedrock. In addition, these wells may offer an opportunity to determine the velocity at which ground water moves through the overburden by injecting a nonhazardous dye tracer in selected wells.

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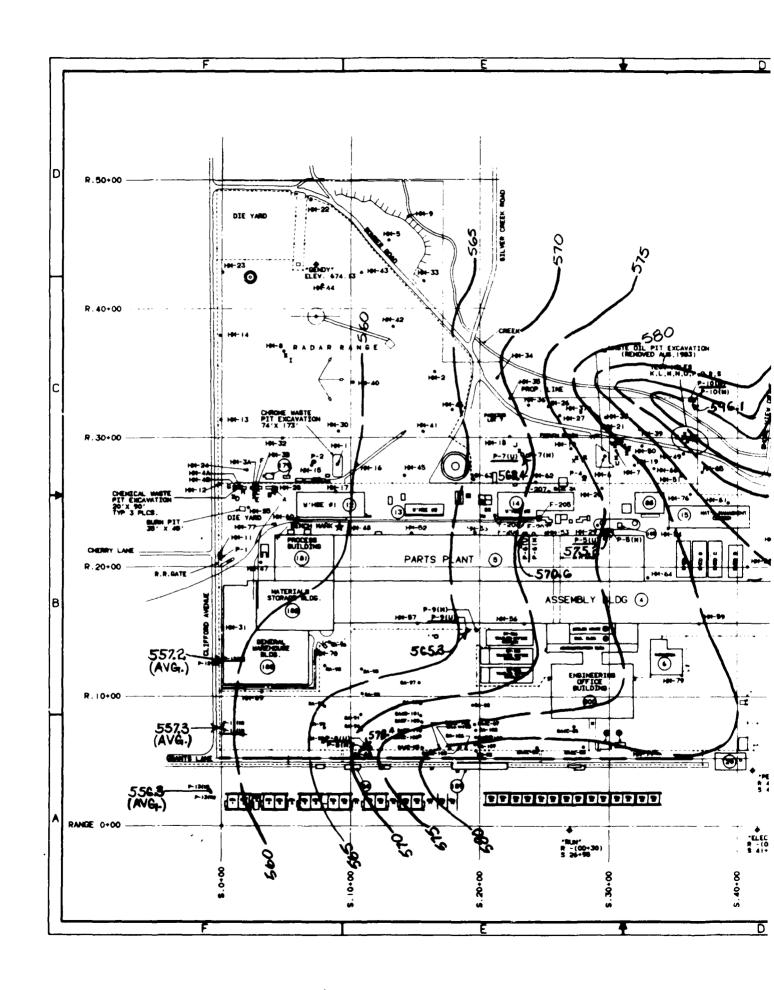
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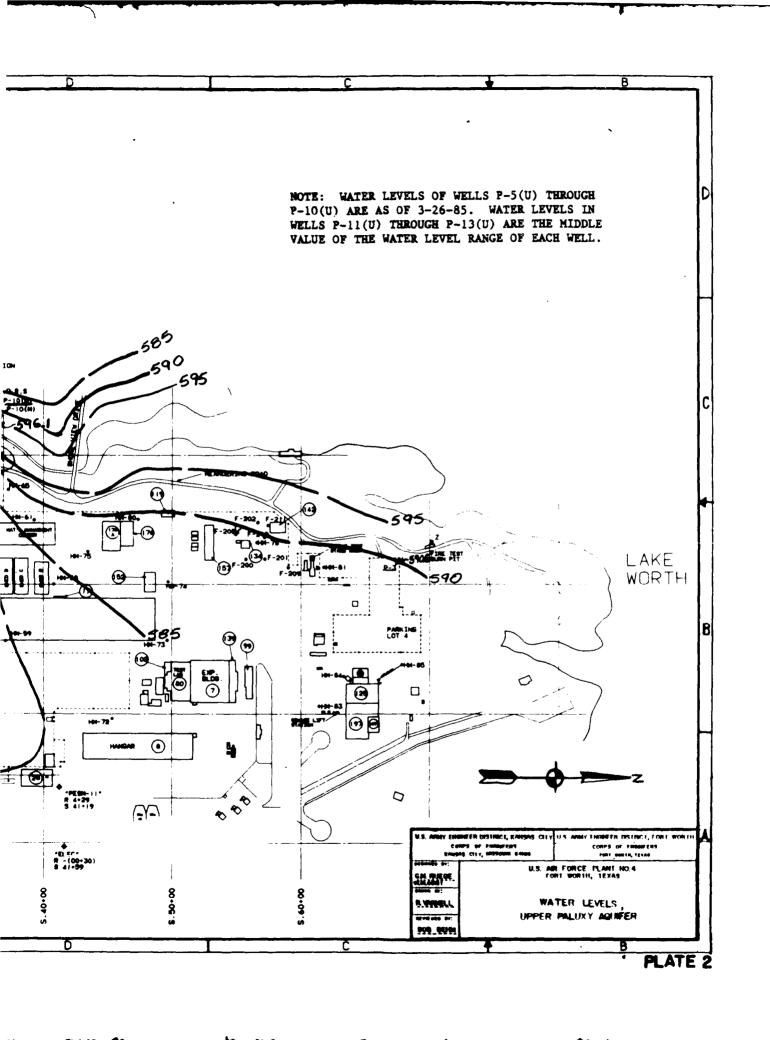
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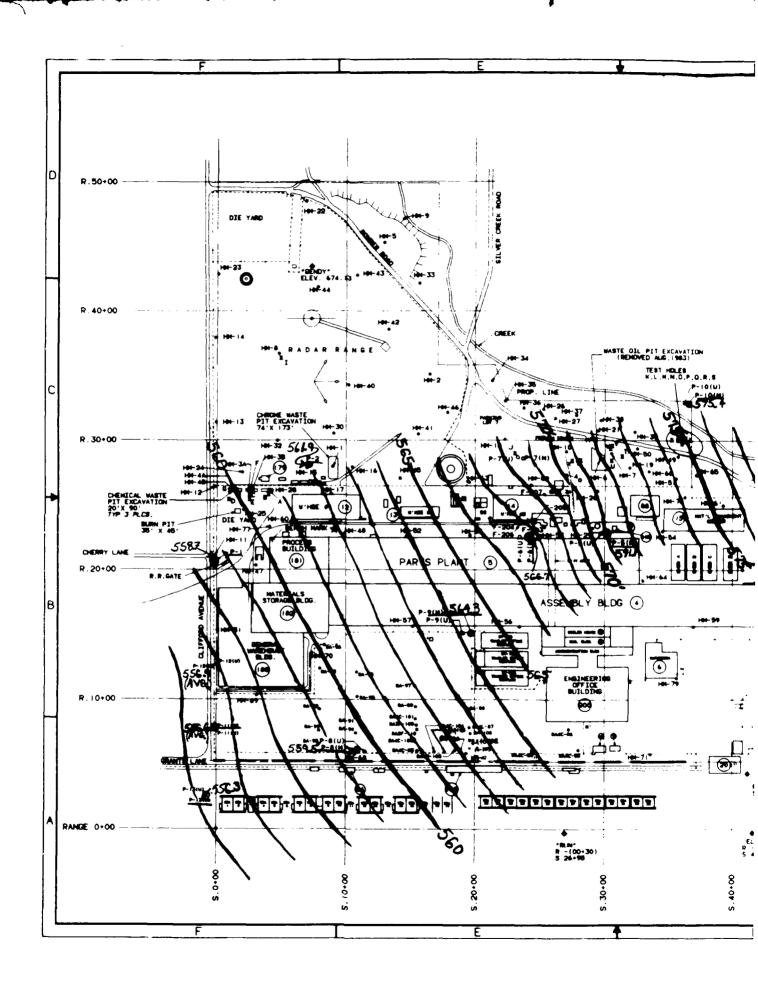
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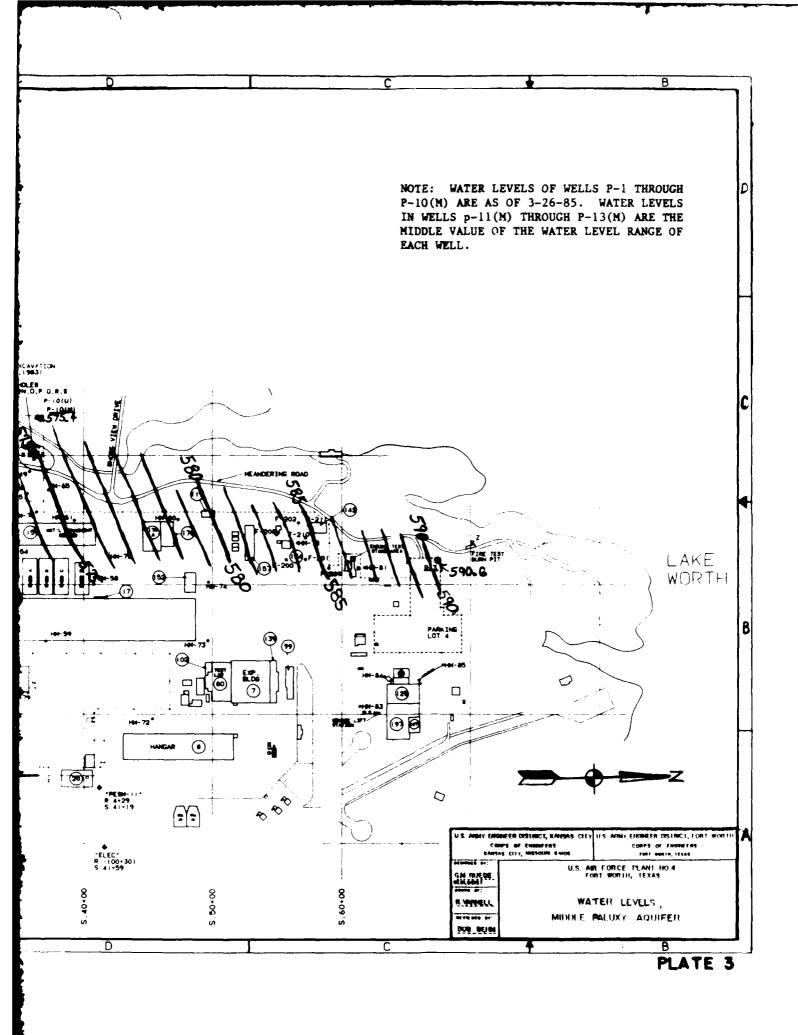
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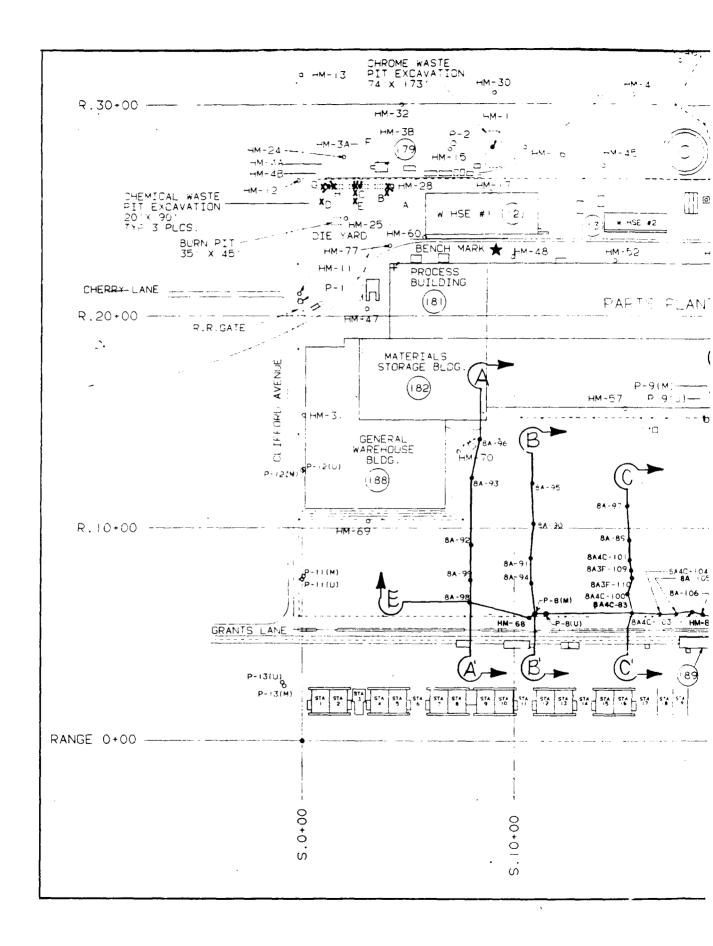
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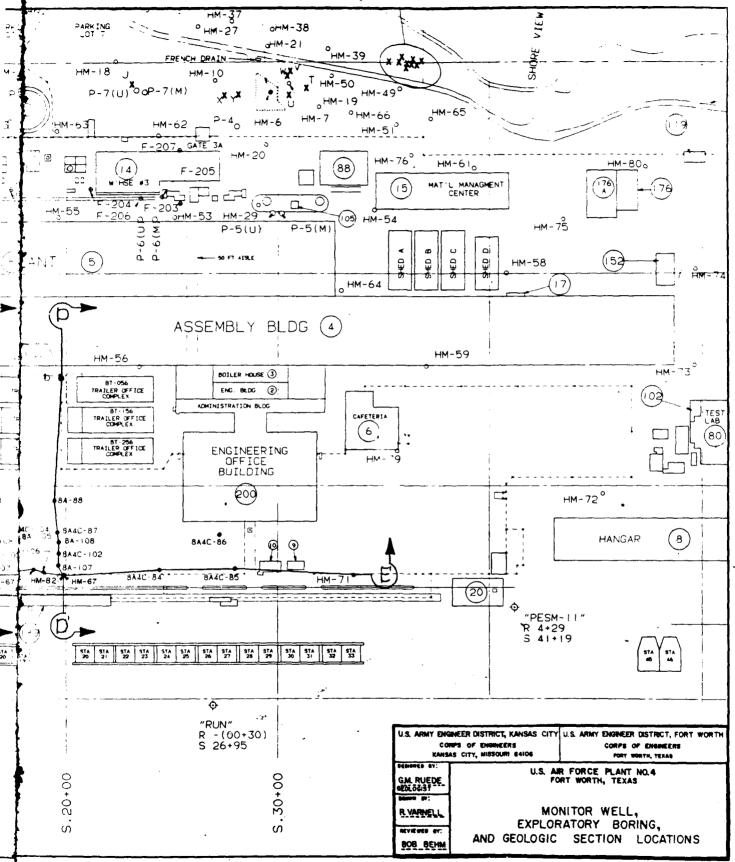
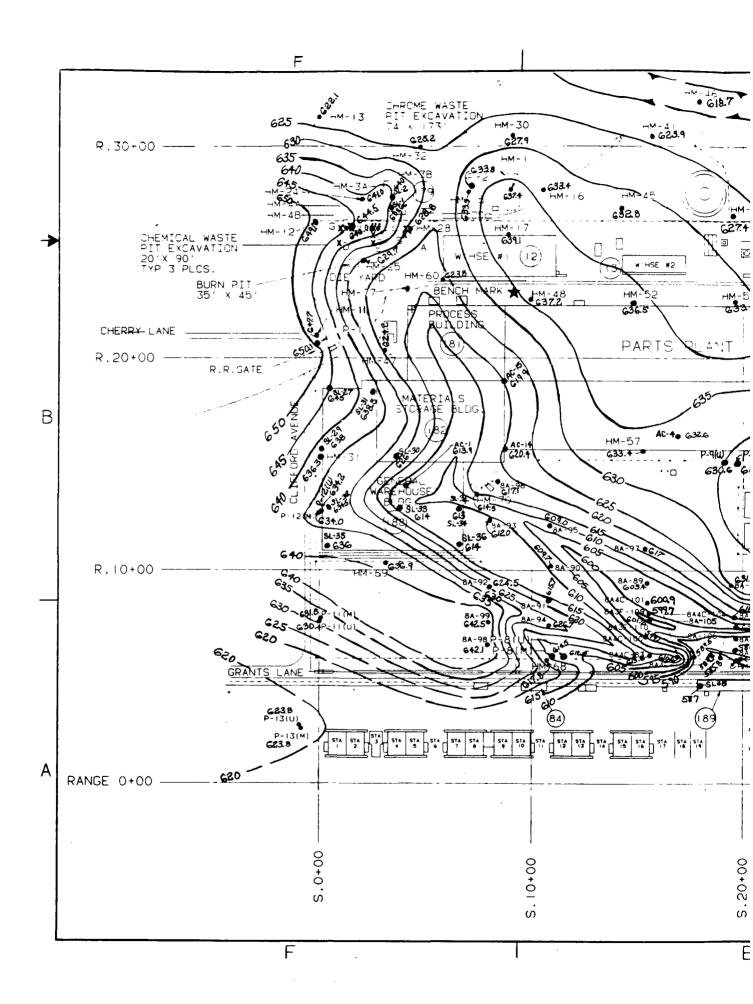
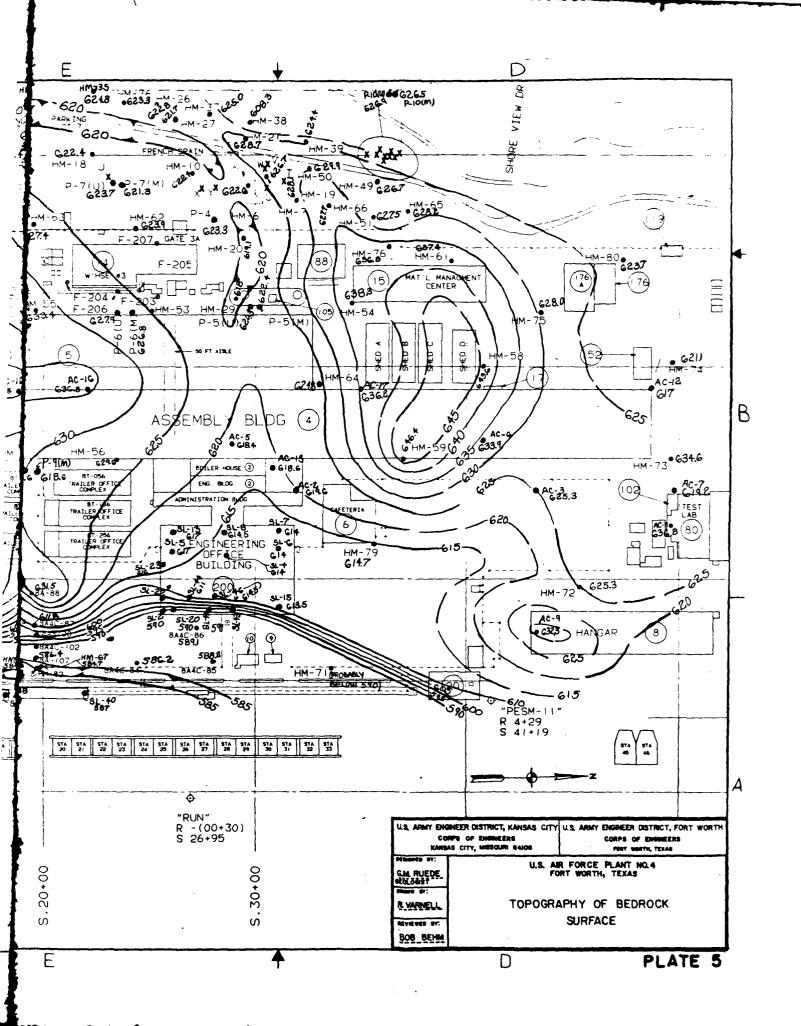
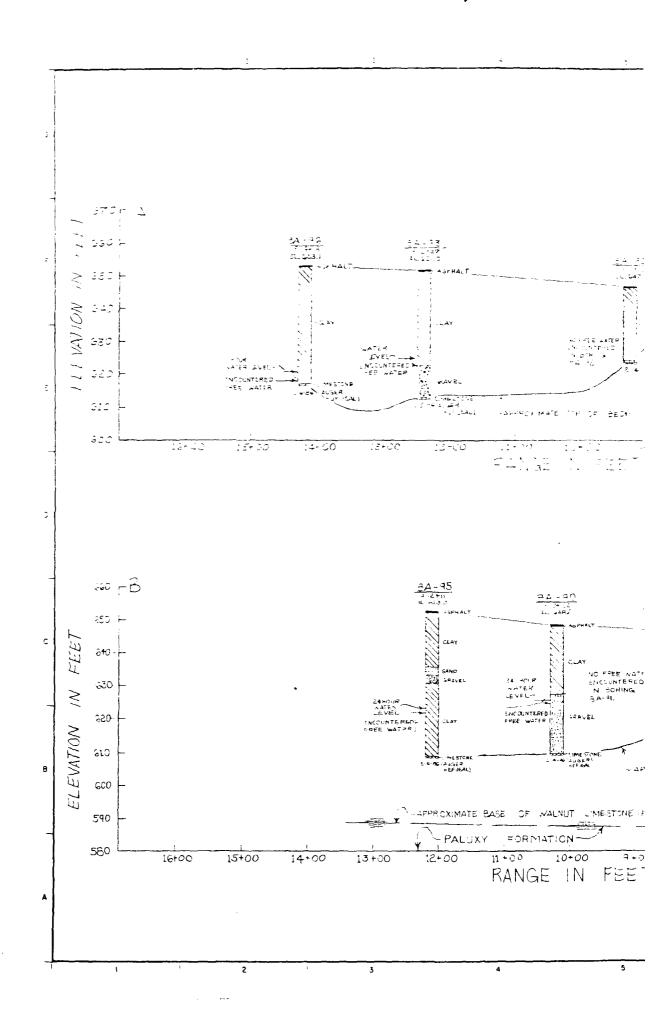
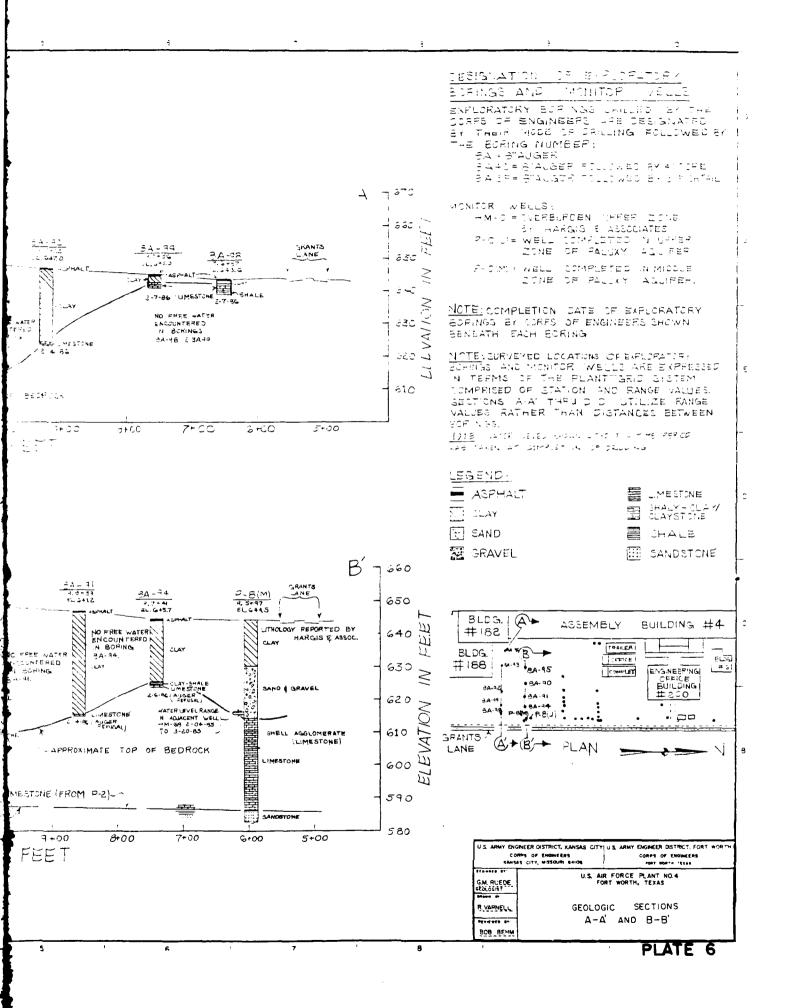


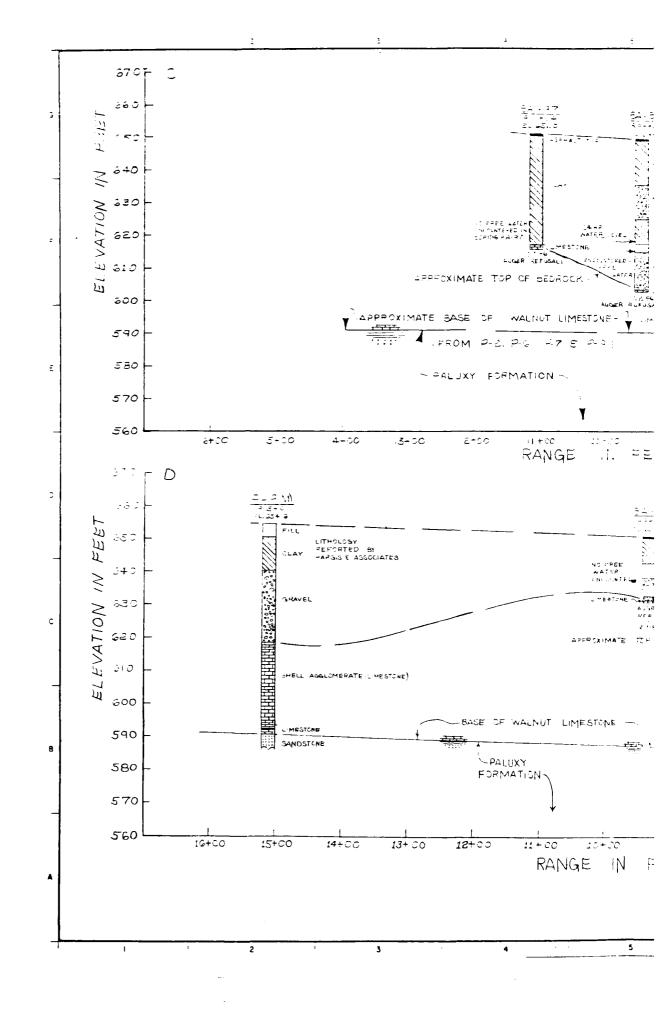
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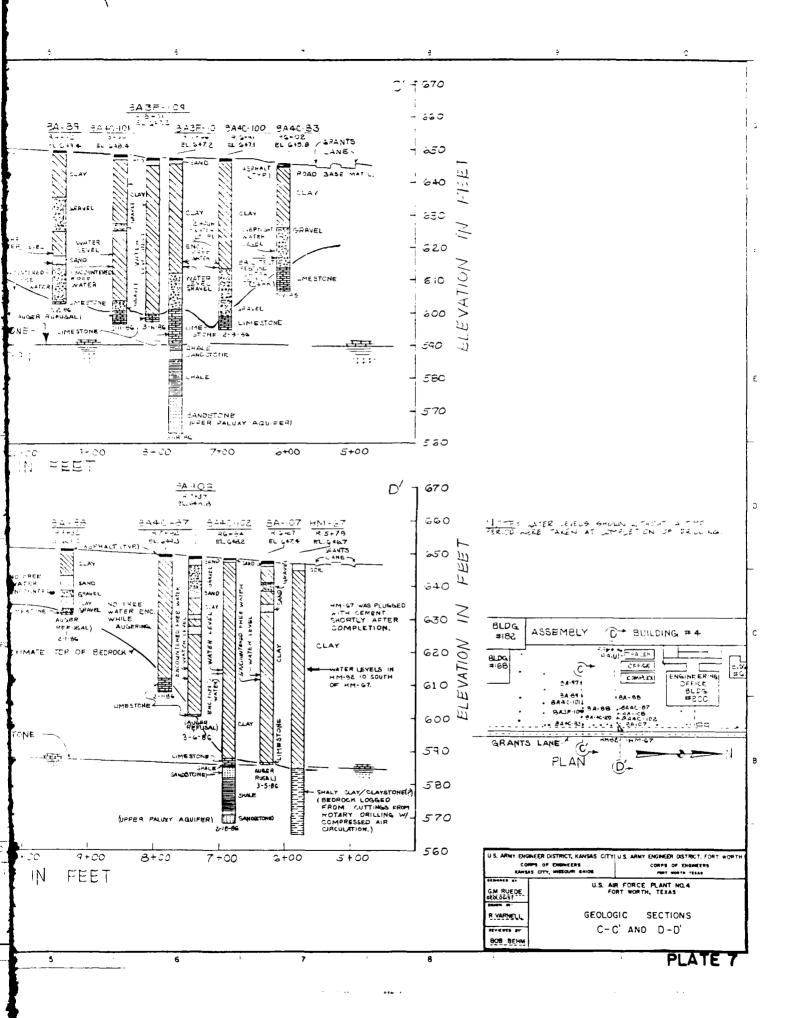


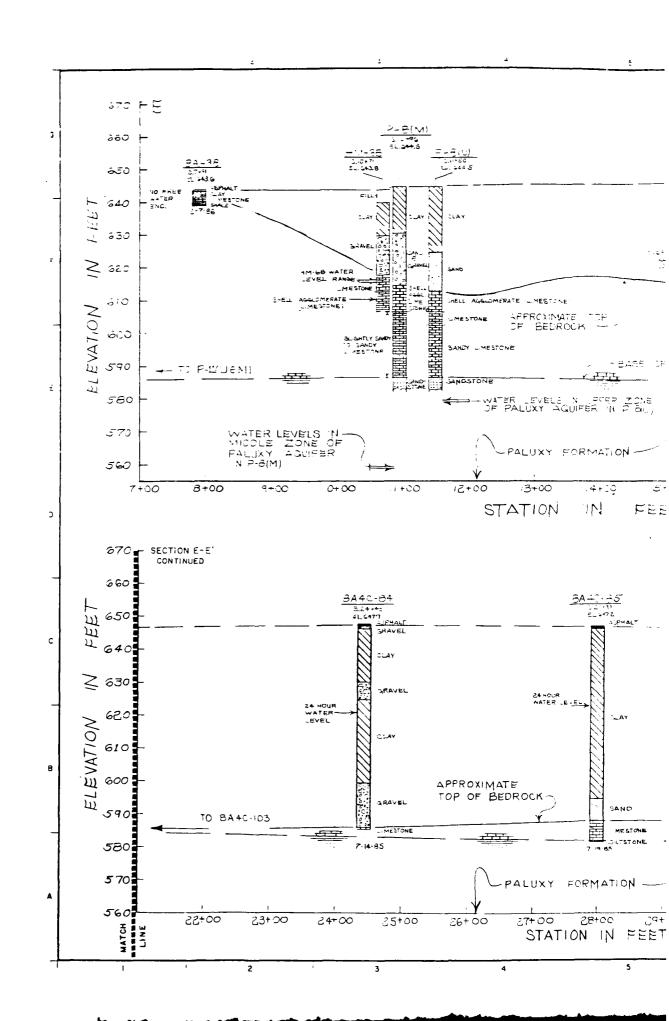


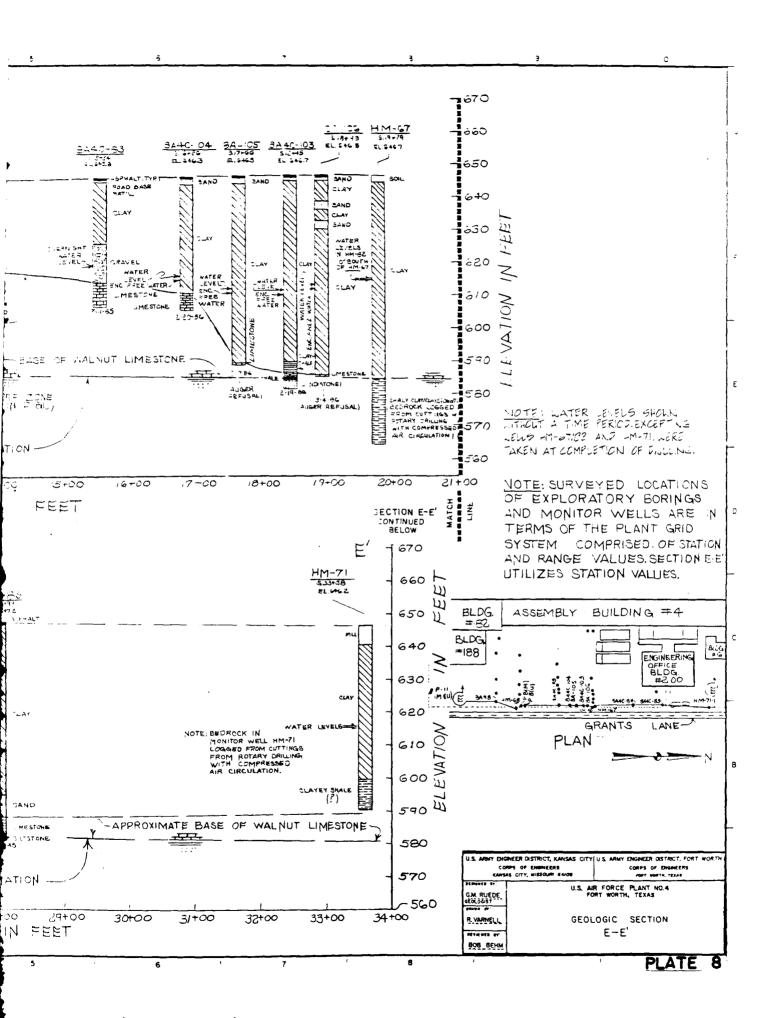












APPENDIX I

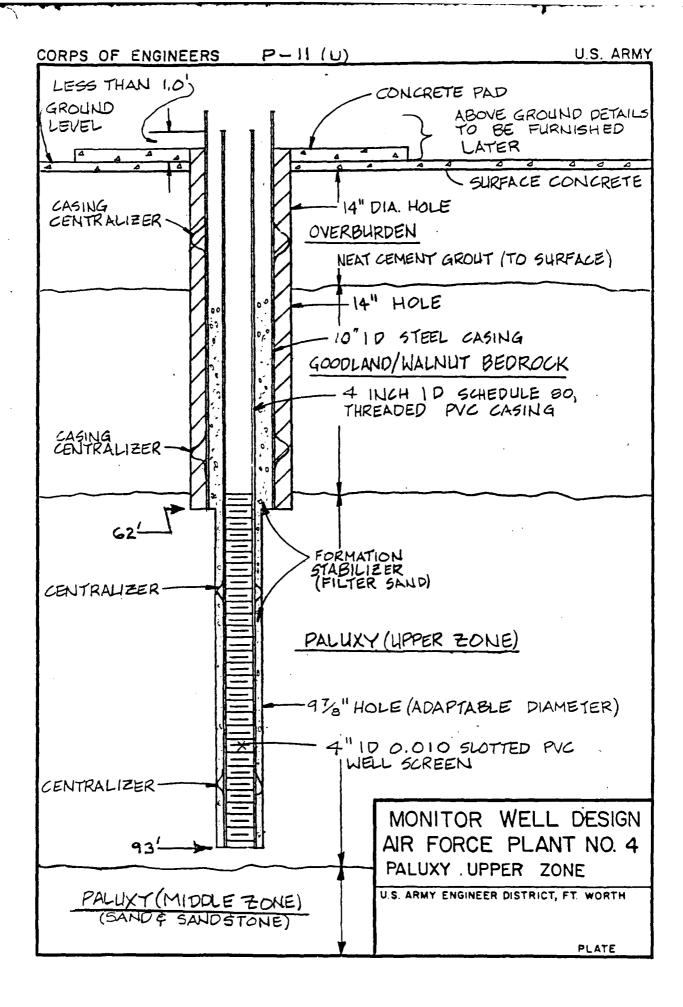
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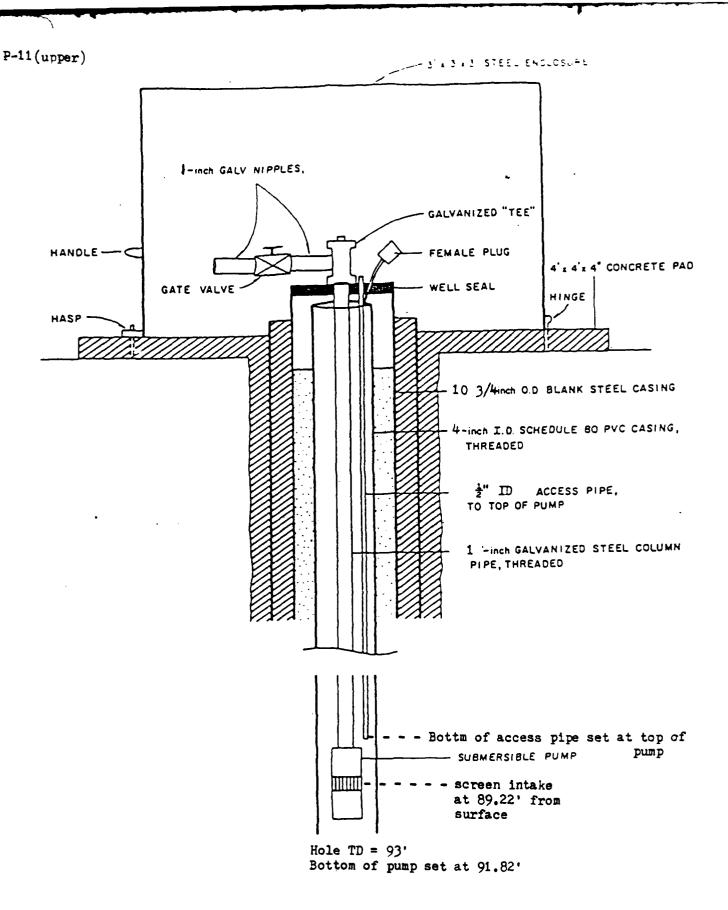
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Joints on pump riser listed from bottom of pump and up to surface: pump length = 4.4°, then 21.1°, 21.0°, 21.12°, 21.12°, 4.0° totals = 92.92° with clayey with acattered clay/shale seams which generally occur in 0.4° thick or less seams, gray and brown, very soft to moderately hard(rock classification), friable, mostly non cemented, but cement noted from drill action. Note: Lithology shown between denths 53.5 and 59.8 feet changed based on reinterpretation of geophysical log.	I						Į.	0,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,		1
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pump and up to surface; SAND SANDSTONE - fine, very silty, numerous silt seams, clayey with scattered clay/shale seams which generally occur in 0.4' thick or less seams, gray and brown, very soft to moderately hard(rock class-ification), friable, mostly non cemented, but cement noted from drill action. Define and up to surface; pump length = 4,4', then 21.1', 21.02', 4.0' totals = 92.92' with 1' stick up. ALL Define Friend ALL Define	1	_=		Paluxy Fm. Transition	n zone	•	į.			
To.1 to 93.0 SAND/SANDSTONE - fine, very silty, numerous silt seams, clayey with acattered clay/shale seams which generally occur in 0.4" thick or less seams, gray and brown, very soft to moderately hard(rock classification), friable, mostly non cemented, but cement noted from drill action. To.1 to 93.0 Dump length = 4.4", then 21.1", 21.02", 4.0" totals = 92.92 with 1 stick up.		-			1		ļ.	listed from	bottom	of
To.1 to 93.0 SAND/SANDSTONE - fine, very silty, numerous silt seams, clayey with acattered clay/shale seams which generally occur in 0.4" thick or less seams, gray and brown, very soft to moderately hard(rock classification), friable, mostly non cemented, but cement noted from drill action. To.1 to 93.0 Dump length = 4.4", then 21.1", 21.02", 4.0" totals = 92.92 with 1 stick up.	ŀ						1	pump and up	to surf	acei
SAND SANDSTONE - fine, very silty, numerous silt seams, clayey with acattered clay/shale seams which generally occur in 0.4" thick or less seams, gray and brown, very soft to moderately hard(rock classification), friable, mostly non cemented, but cement noted from drill action. SAND SANDSTONE - fine, very silty, including silty, numerous silt seams, clayed with 12.1.2', 4.0' totals = 92.92' with 1' stick up. ALL DECTHS FROM SROWN SECUND SURFACE Note: Lithology shown between denths 53.5 and 59.8 feet changed based on reinterpretation of geophysical log.	1	=		70.1 to 93.0	1					
SAND SANDSTONE - fine, very silty, numerous silt seams, clayey with scattered clay/shale seams which generally occur in 0.4' thick or less seams, gray and brown, very soft to moderately hard(rock classification), friable, mostly non cemented, but cessent noted from drill action. 21.12', 21.12', 4.0' totals = 92.92' with 1' stick up. ALL DEFTHS FRIMM SKOUNG SUNFACE Note: Lithology shown between depths 53.5 and 59.8 feet changed based on reinterpretation of geophysical log.	1			7,300	I		l			
silty, numerous silt seams, clayey with scattered clay/shale seams which generally occur in 0.4' thick or less seams, gray and brown, very soft to moderately hard(rock classification), friable, mostly non cemented, but cement noted from drill action. Silty, numerous silt seams, clayed with clayed with scattered clayed with it stick up. ALL DEPTHS FRIME SKOUND SUNFACIE Note: Lithology shown between depths 53.5 and 59.8 feet changed based on reinterpretation of geophysical log.					Į		I			
silty, numerous silt seams, clayer with scattered clay/shale seams which generally occur in 0.4" thick or less seams, gray and brown, very soft to moderately hard(rock classification), friable, mostly non cemented, but cement noted from drill action. Skound SDRFACE Note: Lithology shown between depths 53.5 and 59.8 feet changed based on reinterpretation of geophysical log.	j	J		SAND SANDSTONE - fine	, very		1			
clayey with scattered clay/shale seams which generally occur in 0.4' thick or less seams, gray and brown, very soft to moderately hard(rock classification), friable, mostly non cemented, but cement noted from drill action. 1' stick up. ALL DEPTHS FROM SROUND SDRFACE Note: Lithology shown between depths 53.5 and 59.8 feet changed based on reinterpretation of geophysical log.	ļ	7					1	totals = 92	.92' wi	th I
clay/shale seams which generally occur in 0.4" thick or less seams, gray and brown, very soft to moderately hard(rock classification), friable, mostly non cemented, but cement noted from drill action. Clay/shale seams which generally occur in 0.4" Clay occ	- 1					•	1			í
generally occur in 0.4° thick or less seams, gray and brown, very soft to moderately hard(rock classification), friable, mostly non cemented, but cement noted from drill action. Council Service Seams	- 1	コ						· .	-	ŀ
thick or less seams, gray and brown, very soft to moderately hard(rock classification), friable, mostly non cemented, but cement noted from drill action. Compared to the c	- 1	_		-				ALL DEP-	THS FE	امدرج
and brown, very soft to moderately hard(rock class- ification), friable, mostly non cemented, but cement noted from drill action. Note: Lithology shown between depths 53.5 and 59.8 feet changed based on reinterpre- tation of geophyrical log.	- 1	_=	1							
and brown, very soft to moderately hard(rock class-ification), friable, mostly non cemented, but cement noted from drill action. Note: Lithology shown between depths 53.5 and 59.8 feet changed based on reinterpretation of geophyrical log.	- 1	\neg	i	thick or less seams.	gray		1		-UK- F1	_ '=
moderately hard(rock class- ification), friable, mostly non cemented, but cement noted from drill action. Note: Lithology shown between depths 53.5 and 59.8 feet changed based on reinterpre- tation of geophyrical log.	ŀ	\dashv					ļ			
ification), friable, mostly non cemented, but cement noted from drill action. between denths 53.5 and 59.8 feet changed based on reinterpre- tation of geophyrical log.	i i	╛				_	1	Name of the last		
mostly non cemented, but cement noted from drill action. action. and 59.8 feet changed based on reinterpretation of geophyrical log.	- 1		j		CTERN	-				
cement noted from drill based on reinterpretation of geophysical log.	1	-			İ			between dep	ths 53.	>
cement noted from drill based on reinterpretation of geophysical log.	- 1	╛		mostly non cemented.	but]	and 59.8 fe	et chan	ged l
action. tation of geophysical log.	ŀ	⊐					1			,
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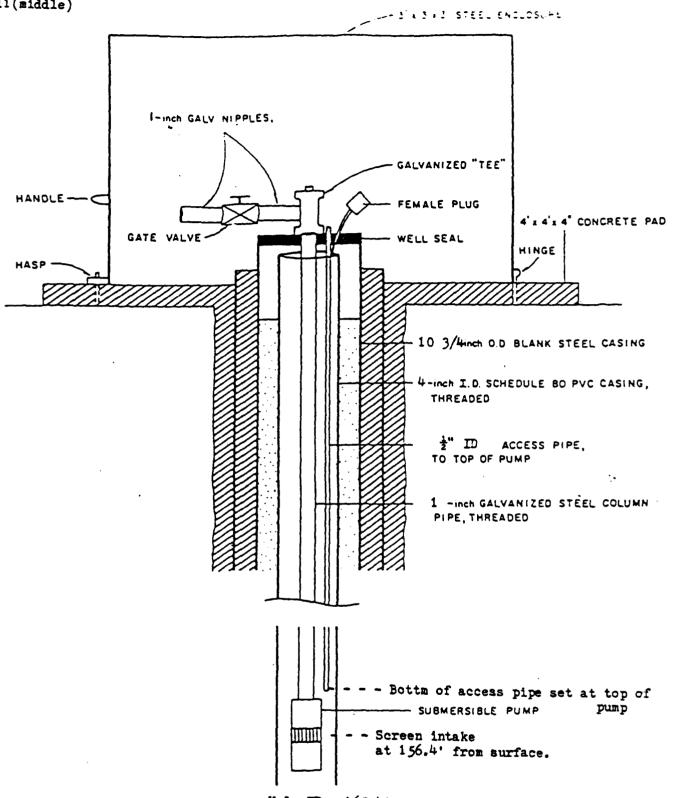


P-11(upper) - Diagram 2 of 2 AF plant #4(GD) - Paluxy Aquifer

							Hole No.	P-11(=)	_
Dett	LINES LC		SWD	MOTAL	MOTTAL	Ft i	forth	OF 2 SHEETS	
I. PROJECT		(22)	Paluxy Aquifer	10. SEZE	AHO TYP	OF SIT		100 - 200-11	1
L.		_					SHOWN (TOWN OF MALE)		1
LOCATION	(Constitu	man or It					SNATION OF BRILL		4
I DANK CHIE	AGENCY			12 800		iling			1
				12 TOT	AL NO. OF			UMDISTURBED	1
4 HOLE NO.	(Aq ato-		P-11(m)	9476	DEK SAMPI	LES TAKE	**		4
E. HAME OF					AL HUMBE				4
Brewer				IL ELE	VATION OF				
4. DIRECTIO				N. DAT	E HOLE	1		6 Aug 85	1
₩ VERT	CAL []	1146 L 114 E C	DES. PROM VERT.		******		G 38, 84		┨
7. THICKNES	s or ove	ERBURDE	7.0				Y FOR SORING		Η.
B. DEPTH DE	HLLED II	ITO ROCI	1 58.4		ATURE OF				H
B. TOTAL DE	EPTH OF	HOLE	165.4_				16hert	Mers	
ELEVATION	DEPTH	LEGEND	CLASSIFICATION OF MATERIA	u	S CORE	BOX OR	Petting time test	IKS	1
		١.	1		ERY	NO.	(Ording time, rate realizating, etc.,	if eignificant	
	_		0.0 to 0.3 - Asphalt.				Note: Litholo	gic units	┲
	=	1	1		}	1	and their co		, -
		1	0.3 to 4.8		i	1	primarily in		. ⊨
	=	!	ATIV		ł .	1	from gamma a	na electric	; E
1	. =	=	CIAY - high plasticit medium stiff, slight		ł		logs.		E
]	10:-	- 7	moist, dark brown, c	. •	l	l	* Drilling		
		-	cal odor at top of u		Í	i			E
	_=	 	l	•	l	l	0 to 12.5' -		
(=	10	4.8 to 7.0			!	12.5 to 106'		·F
	=	 			1	<u> </u>	bit, set 106'		.F
	20:-	11//	GRAVEL - coarse to fi			İ	metal cang an grouted from		°⊨
		111	angular, medium dens slightly moist, brow		1		hole to surfa		F
1	=	 	very sandy and claye		}	1	106 to 161.0'		F
		- 7	101, 1111, 1111 011,	, .		ì	rockbit - t		\vdash
			7.0 to 12.7				bottom of h		-E
	30'-	 1/-				i .	ed to be 16		E
		11	SHALE - weathered to		·	1	driller cla		E
] =	\perp	plastic and very sti			1	out of loos	e sand.	E
		╏┱┸┯	clay consistency, sl moist, yellow brown						F
1		11	gray, slightly limey				**		. =
i .	l ∓	┸╼┸	scattered shell frag					les of fluid	¹⊨
1 1	" "	- 5 -	Walnut Pm.			1	and cuttings at; 60', 70',		F
							100 and 10		F
		141	12.7 to \$4.0				A seperate vi		ᄂ
		165	LIMESTONE - weather s	+= 1 ==		1	fluid and cut	tings taker	ᄟ
	_ =		but mostly white, mo		•		at 165'.		E
	20. —	IV	ataly hard to hard(r						Е
1 !	=	+4	classification), mod						E
i I			ly to well cemented,			ŀ	***		F
1 1		[: :::::	oyster shell somes t				Water che		F
!	. 7		out, numerous soft(r		-)		thing on morr		F
	60:	[: : ::::l	shale seams scattere within - they are ge		l _w	l	hole at 105.		F
		┷┷	less than 1' thick,		۲			, Jan 1	F
1	=	==	some do thicken up t	0			Hole bailed t	o 95' on	F
l i			2.4', ie especially				22 Aug 85 wit		F
j (, ⊐		24.0 to 31.0', unit		i		in hole.		F
į i	70:_		very shaley with san	d.			Water recover		L
<u> </u>			from 54 to 61.5'. Walnut Fm.				within ½ hour		E
1	크	.;:•	1			1			E
[54.0 to 54.8 SHALE	,		1			F
1	∃	= =	54.8 to 61.5 <u>SANDSTON</u> 61.5 to 71.0	<u> </u>		1	 Note: Litholo	gy shown	F
	E-08	; - ; -				ł	between dept	•-	F
]]	~ ¬		SHALE - no apparent w	eath-			and 61.5 fee	•	F
	7	<u> </u>	ering, soft(rx class grey to blue-grey, s				based on rei	•	F
	コ	·	seams throughout, si				tation of ge	ophysical	F
[[⇉	·		/•		l	log.		F
,	a. =	. : : :				l	}		F
]	90:	- : : .			1	I			F
]	∃	امهريسنا							E
, I	Ξ	:				l			E
	\exists	<u> -</u> ;				1			F
[7	- <u>-</u> -				1			F
ENG FORM	444-	· ·	<u> </u>		PROJECT	L		HOLE NO.	ᅩ
MAR 71	1836	PREVIOL	IS EDITIONS ARE OBSOLETE.						

Hole No. P-11 (m)

				THE TALL			Hole No.				
Desti	LING LO		SWD		Ft We	orth		or 2	2		
PROJECT		(CD)	Paluxy Aquifer		AND TYPE		4				
LOCATION	Ant #4	·(GD)	Haluxy Aquifer	11. BATU	e POR EL	EVATION.	SHOWN (THE COME)				
				12. HANG	PACTURE	IPT DESK	BHATION OF BRILL		-		
. DANLLING	AGENCY			12 7074	. **	OVER	DISTURBED	Une De S	TURBED		
HOLE NO.	(Ag about	-	P-11(m)	SURE	DI SAMA	OYER- LES YAKE	ING .				
. HAME OF	DRILLER		: • - • ()			R CORE					
				IL ELEV	ATION OF	NOUND WA		LET			
DIRECTIO			054. FROM VERT.	IG. DATE	HOLE						
. THICKNES				17. ELEV	ATION TO	P OF HO	LE				
DEPTH OF							Y FOR SORIHE				
L TOTAL DE	EPTH OF	HOLE	165.4*	10. SIGN.	TURE OF	HEPECT	Crest McVer				
ELEVATION	DEPTH	LEGENO	CLAMIFICATION OF MATERIA		S CORE	SOX OR SAMPLE	(Drilling time, water	K\$			
•	_	•	_ (MQ.		il signi	-		
			71.0 to 153.3				Instrume	mtst:	lon		
			71.0 00 199.9			1	III CI UI		1011		
	=		SAND/SANDSTONE - no a		t		Set 4" pvc I				
	=	·	weathering, friable, ly to non cemented,				and gravel pa	cked	up to		
	110	· = -	to moderately hard(r				The 4" pvc jo	ints	were		
	l ∃		classification), fin	•			recorded from	the			
	\exists		grained, very silty, a few thin lime stri				up as follows plug and bl		. +		
	╡	٠	scattered, clay/shall				bottom(165.4				
	ا ا		throughout and usual	ly			joints at .6	, 4.	.75'.		
	' <i>&</i> -	\cdots	are less than 1' thi pyrite concretions s				the screens at 19.77', th				
	∃		tered, lignite noted			[]	joints at 9.7				
	\exists	٠. ١	82',	1			9.78', 9.79'	9.7	5.		
			harder somes noted a 123.5 to 124.7', and				9.78 9.76	9.	76',		
. 1	130:-		128.3 to 129.0'.	ł			9.71'.9.78'. 9.79'. 9.79'	3 · (74		
		ا ـ ـ ا	thicker shale/clay s				4.77' which				
	\exists		or very shaley somes	noted			1.3' stick				
	3		at; 77.3 to 79.5',	l			 with stabil! them are inc 				
i	∃		83.8 to 86.1,	1		i	underlining				
- 1	/ ///	<u>'</u>	92.5 to 94',	Į.			above - all				
	コ		96.0 to 99", 104 to 109.8", 127.	2 to			are 5' below	/ S& 1	d Joi n		
	\exists		129', 132.8 to 135', 14	0.0 td			Sad subsessed	12.1.			
ľ	'∃	: • : :	142.2', 144.3 to 145'.	Paluxy	<u>Fa</u> .		Set submers: (Standard,1/2				
	150			l			at 110') do	own t	0 159'		
	~ 	: : :	153.3 to 165.4	}			with intake				
	=	ا+ ب	GAMES A CHARES A A S				above bottom this is followed				
1	\exists	;	SAND and SHALE interb sand is fine, friabl				sections of				
i	Ε	·±:	silty, the shale is				pipe all of				
)	160-	1	grey, both are soft(xx		;	a 21,2' leng				
	Ⅎ	·÷: -	class),	ŀ			section of				
j	165:-			j			at top incl				
	· =			ĺ			stick up.				
	月	1		1			For further	det	ile o		
ĺ	\exists	1		İ			installation				
	Ε			l			diagram.				
i	긬	ł		- 1			ALL DEPT	HS 1	-ROM		
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Hole TD = 165.4Bottom of pump set at 159'.

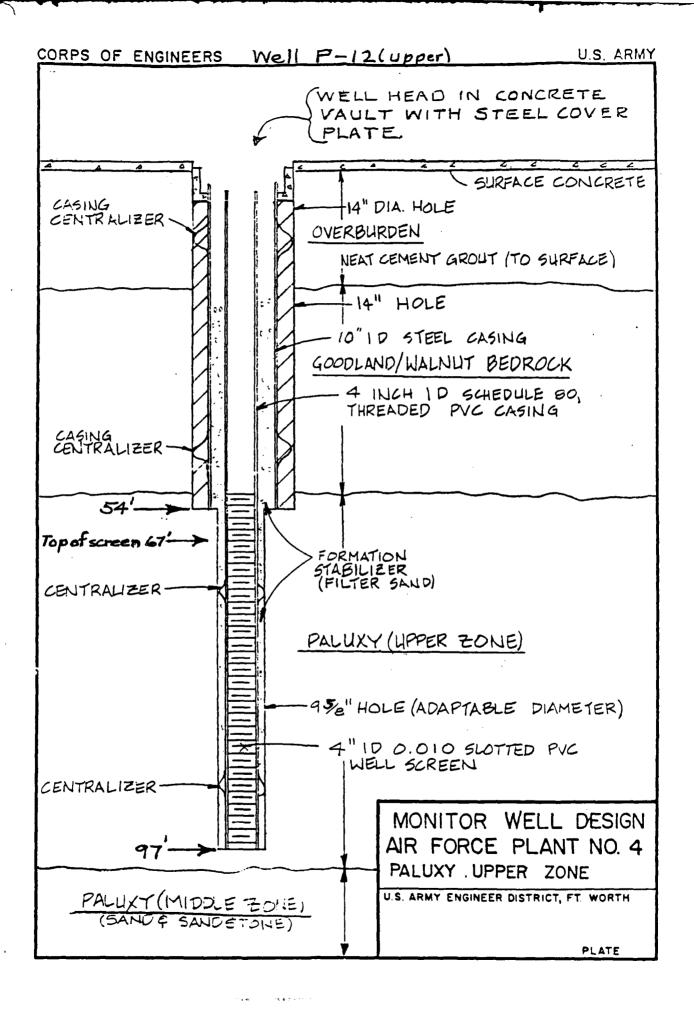
P-11(middle) - Diagram 2 of 2 AF Plant #4(GD) - Paluxy Aquifer

P-12(u) DRILLING LOG Ft Worth SWD .F. Plant #4(GD), Paluxy Aquifer LAZATON /C. 12. MANUPACTURER'S DESIGNATION OF BRILL DAN LINE AGENCY Failing 1500 USCE 12 TOTAL HO. OF OVER-HOLE NO. (As at P-12(u) 14. TOTAL NUMBER CORE BOXES NAME OF BRILLIA IL ELEVATION CROWNS WATER Brewer 16 Sept 85 24 Sept 85 M. DATE HOLE WALLINED ---17. ELEVATION TOP OF HOLE 643.64 7. THICKNESS OF OVERBURDEN 16. TOTAL CORE RECOVERY FO DEPTH DRILLED HITO ROCK 87.6 TOTAL DEPTH OF HOLE 97' CLASSIFICATION OF MATERIALS HECOV-LEGEN 0.0 to 0.5 - Concrete. Note: Lithologic units 0.5 to 1.0 - Base GRAVEL. and their contacts wre primarily interpreted 1.0 to 3.3 by project geologist from gamma and electric CLAY - high plasticity, logs. stiff, slightly moist, dark brown, slightly sandy * Drilling 3.3 to 8.7 0 to 0.5' - 14" rockbit, 0.5 to 10.5' - 14" auger, 10.5 to 97' - 14" rock-GRAVEL and SAND interbedded both are coarse to fine, bit, medium dense, slightly set 52' of 10" metal moist, dark brown to white casing after 54' attainclayey and combles up to ed. The casing was then 6", calcareous. grouted in from the bottom and up to surface 8.7 to 9.4 CLAY - high plasticity, Vial samples were stiff to very stiff, taken at the following slightly moist, yellow depths: brown, lime nodules, cyste at 4' - auger cutshells, sandy and gravelly possibly a reworked shale. at 97' - rockbit cuttings in one vial and drill fluid in another. 9.4 to 54.6 LIMESTONE - weather stains, white with yellow brown. dole bailed after moderately hard to hard completion of drilling. (rock classification), Water level taken after moderately to well cementinstallation of 4" pipe ed, soft(rx class) shale at 87.9'. seams scattered throughout, oyster beds within. Very shaley some from 15.9 to 25.5'. Installation 54.6 to 55.2 SHALE 55.2 to 59.0 SANDSTONE Set 4" pvc pipe to TD of 97' with screen fi with screen from 59.0 to 72.8 97 to 67'(plug in bot-SHALE and SAND interbedded tom) and blanks to sand is fine grained and surface with 1' stick friable, shale is an unweathered dark gray, No pump installed. both are soft(rx class). Pipe to be set inder ground at a later date. Pump for sampling installed later. ALL DEPTHS FROM GROUND SURFACE

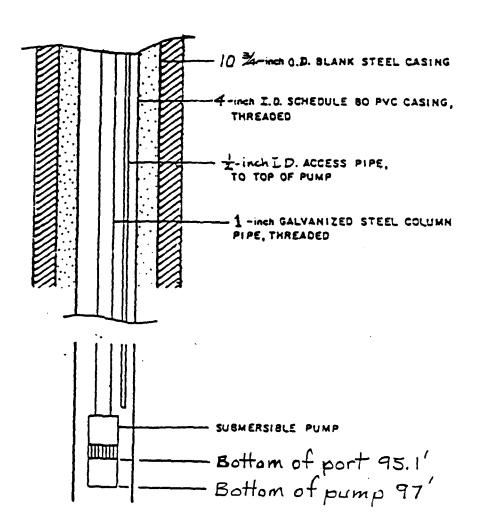
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M-1-M- P-12(u)

							10010	F-12(u)		
DRILL	LING LO	6	SWD	HESTALL F	ATION t Hort	h		SHEET 2		
A.F. Plant #4(GD), Paluxy Aquifer					AND TYP	OF BIT	*			
LOCATION	int -	GU),	METURY AQUITOR	11. DAYON FOR ELEVATION SHOWN (YOU or ZIL)						
				12. HANK	PACTURE.	IF S GERA	MATION OF GRE	u		
DMICLING						-	CHSTURGED	. WISTOTURSED		
HOLE NO.	(An other		P-12(u)	12 1017	En Eliza	OVER-	m	CHRISTONSED		
HAME OF	DRILLER		; F-12(U)			R CORE S				
				IL ELEV	ATION O	NOUND WA				
DIRECTION			DEG. PROM VERT.	M. DATE	HOLE	874	ATED	COMPLETED		
				17. ELEV	ATION TO	P OF HO	LE			
DEPTH OR							Y FOR SQRING			
TOTAL DE			97'	10. SIGN/	ATURE OF	INSPECT	·	Mavon		
LEVATION	_	LEGEND	CLASSIFICATION OF MATERIA	4	3 CORE	DOX OR	R	MARKS /		
		reasur	(Prooription)		RECOV	SAMPLE NO.	Drelling stone	mater loss, death of etc., if elgaticated		
		ŢŢ	72.8 to 97.0			<u> </u>				
1	╡	- 	72.0 to 97.0	- 1			Note: Lit	hology shown		
			SAND/SANDSTONE - fine	grain				depths 54.6		
	∃	\perp	ed, friable, mostly	reak		i l		feet changed		
- 1	⊣	+++	to non cemented, some					reinterpre-		
	コ		erately comented seas shale seams scattered					of geophysical		
ļ	⇉		lime stringers within				log.			
İ	ーコ	•	overall has a grey to	11gh	;					
l	╛	: : : : : :	grey color, soft(rx o	lass)	,					
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i	60 -	$\equiv \exists$		1	į					
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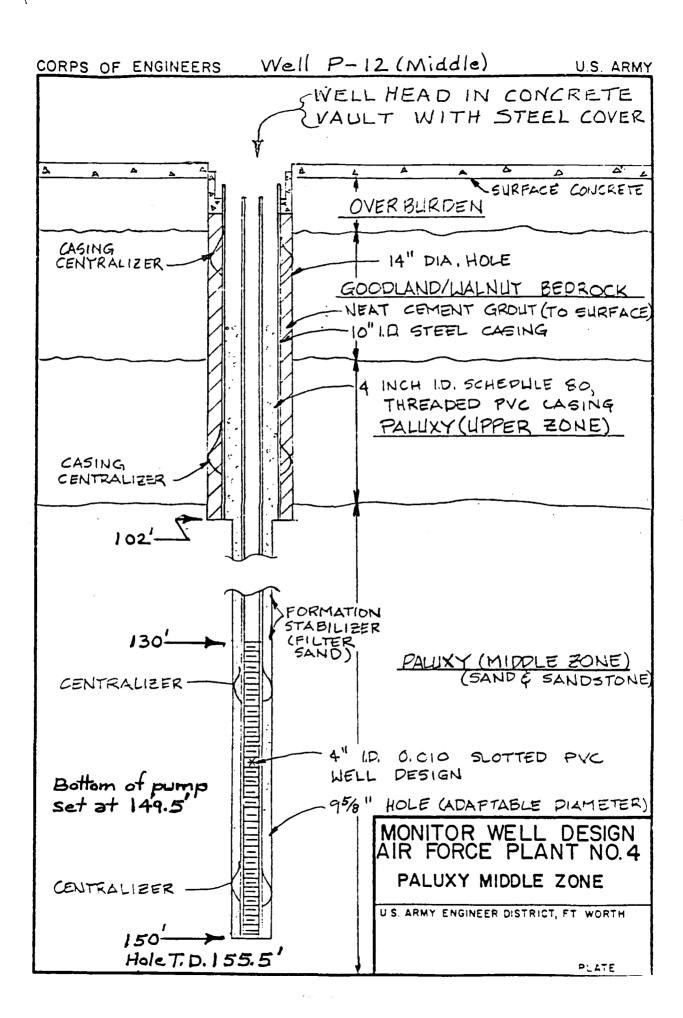
WELL P-12 (U)



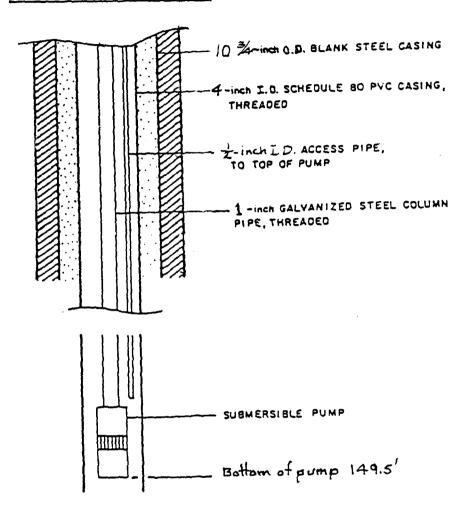
Note No. P-12(M) W 7 7 00 2 SHEETS DEILLING LOG Pt Worth SWN M. MIE MID TYPE OF BIT .F. Plant #4(GD), Paluxy Aquifer LATER TO THE RESIDENCE OF THE PARTY OF THE P IL MANUFACTURER'S DEMONATION OF CRILL SCE ASENCY Failing 1500 13. TOTAL NO. OF OVER-HOLE NO. (As shown an absented title P-12(M) 14. TOTAL NUMBER CORE BOXES HAME OF BOILE IL ELEVATION GROUND WATER Brever 16 Sept 85 3 Sept 85 M. DATE HOLE TVERTICAL CHELINES 17. ELEVATION TOP OF HOLE 643,54 9.4 THICKNESS OF OVERSUSDEN 18. TOTAL CORE RECOVERY FOR SORING 18. TOTAL CORE RECTOR DEPTH DRILLED WITG SOCK 146.1 McVe TOTAL DEPTH OF HOLE 155.5 CLASSIFICATION OF MATERIALS LEVATION DEPTH LEGENG 0.0 to 0.5 - Concrete. Note: Lithologic inter-0.5 to 1.0 - Base GRAVEL. pretation and their contacts were determined 1.0 to 3.5 by the project geologist primarily from CLAY - high plasticity, gamma and electric logs stiff, slightly moist, 14.64 dark gray to dark brown, · Drilling 3 1) 6 sandy and gravelly, calcardous. 罪 0 to 0.5' - 14" rockbit. 0.5 to 10.5' - 14" auger. 日子日3.5 to 8.7 10.5 to 155.5' - rock-177 bit, SAND and GRAVEL interbedded met 103' of 10" metal both are coarse to fine pipe of which one foot grained, medium dense, was stick up. slightly moist, dark brown The cang was then groutclayey, cobbles, calcareous, ed up from the bottom to the surface. 8.7 to 9.5 Installations CLAY - high plasticity, stiff to very stiff, slight Set 4" pvc pipe to TD ly moist, yellow brown. with intake screen from lime nodules and concent-T) 150 to 130'. This pipe rations, sandy and gravelly, was then graveled up to possibly a reworked shale. 77'. The bottom of pump was then set at 149.5' 40 and 1" riser pipe to surface with 1' stickup. 9.5 to 54.4 LIMESTONE - weather stains All pump and pipe system throughout, white and yelto be set under ground low brown stains, moderately at a later date. hard to very hard(rock class Diagram to be completed ification), moderately to when above system comwell comented, oyster leted. shells throughout with dense oyster beds within, shale seams scattered throughout as are lignite Hole bailed after comseams, a very shaley some pletion of drilling. is encountered from 10.9 Water check on 17 Sept to 15.8', the shale is 1985 at 87.9'. soft(rock classification). 54.4 to 55.0 SHALE 55.0 to 58.8 SANDSTONE Vial samples taken at: one from aug-58.8 to 72.6 er cuttings SHALE and SAND interbedded one from drill fluid sand is fine grained and friable, shale is essentially rockbit cuttings at unweathered dark grey, 155.5'. both are soft(rx class) ALL. DEPTHS FROM GROUND SURFACE with lignite seams and lime stringers within.

MOLE NO.

P-12(M) Ft Worth DRILLING LOG SWD OF 2 SHEETS 10. SIZE AND TYPE OF DIT A.F. Plant #4(GD), Paluxy Aquifer 12. MANUFACTURER'S DESIGNATION OF ORILL USCE 13. TOTAL NO. OF OVER-HOLE HO. (As P-12(M) 14. TOTAL HUMBER CORE BOXES IS ELEVATION GROUND WATER DIRECTION OF HOLE 16. DATE HOLE TYERTICAL THELINED 17. ELEVATION TOP OF HOLE . THICKNESS OF OVERSURDEN 16. TOTAL CORE RECOVERY FOR SOR DEPTH ORILLED INTO ROCK 19. SIGNATURE OF INSPECTOR Mever 155.5 TOTAL DEPTH OF HOLE # COME CLASSIFICATION OF MATERIALS ELEVATION DESTM LEGENG 72.6 to 155.5 Note: Lithology shown between depths 54.4 SAND/SANDSTONE - Paluxy Fm. and 65.8 feet changed fine grained, no apparent weathering, friable, non based on reinterpretation of geophysical cemented to weakly cementlog. ed from top of unit to 115.5', then cementation tends to increase in hardness and frequency of appearance, light grey, some white, lime stringers scattered, shale seams and sones scattered throughout ie, 100.5 to 102', 114.2 to 115.5', 145.4 to 148', and 153.1 to 154.3', this unit overall varies from soft to moderately hard(rock classification). ENG FORM 1836 PREVIOUS EDITIONS ARE DESOLETE.



WELL P-12(M)



Hele No. P-13(u) METALLATION MEET DRILLING LOG OF 3 SHEETS Ft Worth PROJECT 10. SIZE AND TYPE OF BIT # Air Force Plant #4 Paluxy Aquifer 12. MANUFACTURER'S DESIGNATION OF DRILL Failing 1500 USCE HOLE HO. (As also use an drawing state) 13. TOTAL NO. OF OVER-0 P-13(u) 14 TOTAL NUMBER CORE BOXES A MAME OF DRILLE IL ELEVATION GROUND WATER S. DIRECTION OF HOLE 7 Jan 86 30 Jan 86 VERTICAL MINCLINED DES. FROM VERT 17. ELEVATION TOP OF HOLE 638./8 7. THICKNESS OF OVERBURDEN 14.4 IB. TOTAL CORE RECOVERY FOR BORIS . DEPTH DRILLED INTO ROCK 76.1 19. SIGNATURE OF INSPECTOR D TOMES BOX OF SAMPLE Musli TOTAL DEPTH OF HOLE 90.5 CLASSIFICATION OF MATERIALS REMARKS ELEVATION DEPTH LEGEND (Drilling time, mater lose, depth of meetiering, etc., if eignificant i* Drilling 0.0 to 6.9 CIAY - fill, medium plasti-city, moderately stiff, 0.0 to 14.5' - 10" auger, 14.5 to 68.0' - 12" pilot bit & 14" rockbit. 68 to 90.5' - 10" rockslightly moist, black to brown, scattered gravels. bit. 6.9 to 8.9 2. Bedrock lithologies CLAY - medium plasticity, identified from drill moderately stiff, slight-ly moist, black/brown, cuttings, rate of bit penetration, and from scattered gravels. electric log. 8.9 to 14.4 3. Casing: 10" steel casing set to 68' with cement cir-GRAVEL - slightly cobbly, clayey, slightly moist. culated to the ground surface. 4" pvc, 0.010 slot 14.4 to 26.0 screen set 90.1' to 70.1'. SHALE - calcareous. 4" pvc schedule 80 csg set from 70.1 to surface 26.0 to 28.3 . <u>Pump:</u> 2 7/8" dia, 20 stage, LIMESTONE - shaly. 20 single phase, model 2x4 P050, 8gpm(max) 28.3 to 55.3 pump, made by Standard Pump Co., Bartlesville, LIMESTONE - few shale Ok. Pump suction at seams except from 42.0 to 88.1' below ground 47.5' where shaly. surface.

PROJECT

HOLE NO

ENG FORM 18 36 PREVIOUS EDITIONS ARE OBSOLETE.

Hole No. P-13(u) INSTALLATION MEET DRILLING LOG SWD Ft Worth OF 3 SHEETS OUT COL 16. SIZE AND TYPE OF SIT Air Force Plant #4. Paluxy Aquifer LOCATION (Countinates or Station) 12. MANUFACTURER'S DESIGNATION OF DRILL 1 DRILLING AGENCY 12. TOTAL NO. OF OVER-HOLE NO. (As shows on drawing title P-13(u) 14. TOTAL NUMBER CORE BOXES L HAME OF DRILLER IL ELEVATION GROUND WATER L DIRECTION OF HOLE 16. DATE HOLE - VERTICAL - INCLINED DES. FROM VERT 17. ELEVATION TOP OF HOLE 7. THICKNESS OF OVERBURDEN 16. TOTAL CORE RECOVERY FOR B DEPTH ORILLED INTO ROCK TOTAL DEPTH OF HOLE 90.5 ames) PERY BOX OF SAMPLE REMARKS no, mater loss, depth of G. ofc., if eignificant CLASSIFICATION OF MATERIALS ELEVATION LEGENO 55.3 to 56.0 SHALE -56.0 to 63.7 SANDSTONE - silty. 63.7 to 72.0 SHALE. 50 72.0 to 76.0 SANDSTONE - very silty decreasing with depth to slightly silty. 76.0 to 90.5 SANDSTONE - contains a number of shale streaks and thin seams. - T.D. 90.5' -HOLE NO.

PROJECT

Hole No. P-13(u) SHEET 3 HSTALLATION DRILLING LOG SWD Ft Worth MOJECT M. SIZE AND TYPE OF BIT Air Force Plant #4, Paluxy Aquifer 12. MANUFACTURER'S DESIGNATION OF ORILL HOLE NO. (As shown an drawing title 19. TOTAL NO. OF OVER-P-13(u) 14. TOTAL NUMBER CORE BOXES MAME OF DOLL FO IL ELEVATION GROUND WATER L DIRECTION OF HOLE 16. DATE HOLE TVERTICAL TINCLINED 17. ELEVATION TOP OF HOLE 7. THICKHESS OF OVERSURDEN 18. TOTAL CORE RECOVERY FOR SC B. DEPTH DRILLED INTO ROCK ATURE OF INSPECTOR S/COME BOX CO TOTAL DEPTH OF HOLE 90,5 REMARKS CLASSIFICATION OF MATERIALS ELEVATION LEGENO DEPTH 90

PROJECT

PLATE

Paluxy Monitor Well P-13(U)

STALL AND ST OF SHEETS DRILLING LOG Fort Worth :WD 10. SIZE AND TYPE OF SIT 14" Reamer Air Force Plant Number 4 LOCATION /C. Paiuxy Aquifer Follution Investigation 12 MANUFACTURER'S DEMENATION OF GAILL
ORILLING ASSENCY
Pailing 1500 Failing 1500 USCEC 13. TOTAL NO. OF OVER-HOLE NO. (As about as de P 1 4 - M 14. TOTAL NUMBER CORE BOXES HAME OF DRILLER IL ELEVATION GROUND WATER See comment 1 Brewer -COMPLETED A DIRECTION OF WOLF IS. DATE HOLE 16 Dec. 35 DEG. PROM VER X VERTICAL INCLINED 637.83 17. ELEVATION TOP OF HOLE 7. THICKNESS OF OVERBURDEN 14.0 18. TOTAL CORE RECOVERY FOR BO DEPTH DRILLED INTO ROCK MATURE OF INSPECTOR S. TOTAL DEPTH OF HOLE PÉMARKS CLAMIFICATION OF MATERIALS ELEVATION DEPTH LEGEND ete. II ele Water Level 0.0' to 5.5' No water level was CLAY FILL: black-brown; taken prior to the medium plasticity; medium grouting of the casing. stiff; slightly moist; scattered gravel. 5.5' to 8.5' CLAY: plack-brown; Drilling Methods medium plasticity; medium 0.0 - 14.5stiff; slightly moist; auger. scattered gravel. 14.5 - 56.0 - reamer (11" rockbit with a 14 8.5° to 14.0° expander). GRAVEL: some cobbles; 56.0 - 77.0 - 10" clayey; slightly moist. rockbit. 77.0 - 100.0 - 6" 14.0' to 26.0' core barrel. SHALE: Reamed the hole to 100° calcareous. Identified with the reamer. by cuttings, rate of bit 100.0 - 110.0 - reame Electric logged the hol penetration, and electric Placed 103' of steel log only. casing. 26.0' to 28.0' Grouted the casing in LIMESTONE: place. Drilled the Front out Shaly. Identified by of the casing. 20 cuttings, rate of bit From 14.0° to 77.0° penetration, and electri the lithic descriptions log only. are generally based 28.0' to 55.5' upon electric log interpretations. LIMESTONE: occassional shale seams. Identified by cuttings, rate of bit penetration, and electric log only.

Hole No. P 12 - M

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B. HAME OF	DRILLER					OT AL HUMO			
			Brewe	r	16. 2	LEVATION (TER See comme	
4. DIRECTIO				DE4. FRG		ATE HOLE			OMPLETED
₩ VEATI			<u>' — — — — — — — — — — — — — — — — — — —</u>			LEVATION 1			Jan 86 (110')
7. THICKNES				14.0	<u> </u>			Y FOR BORING	55.0
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9. TOTAL DE	EPTH OF	HOLE						Randi	richain 2
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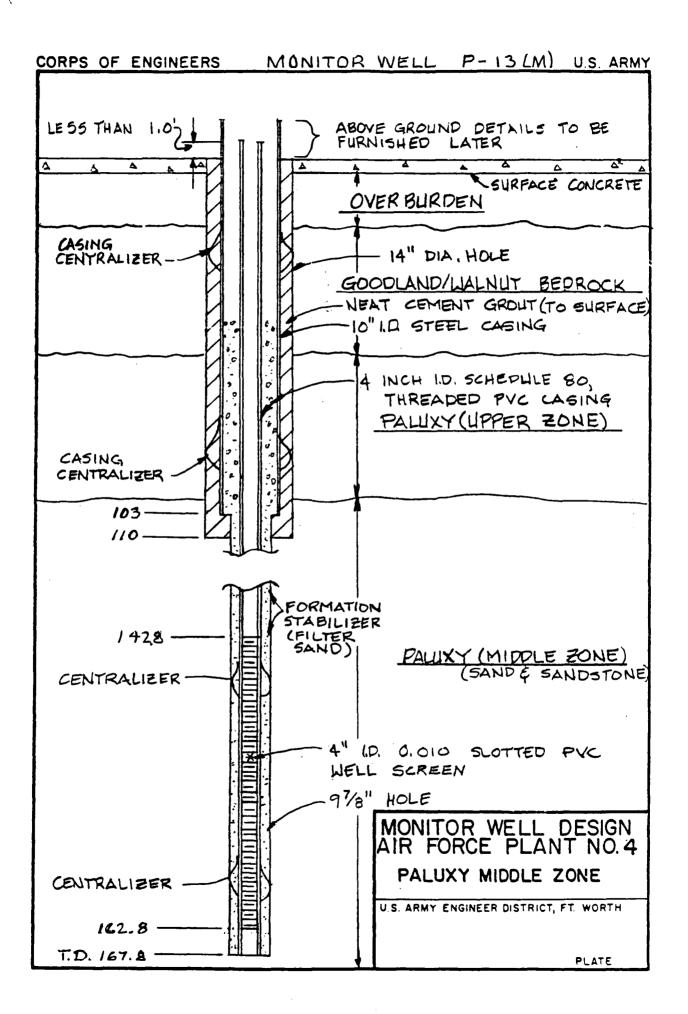
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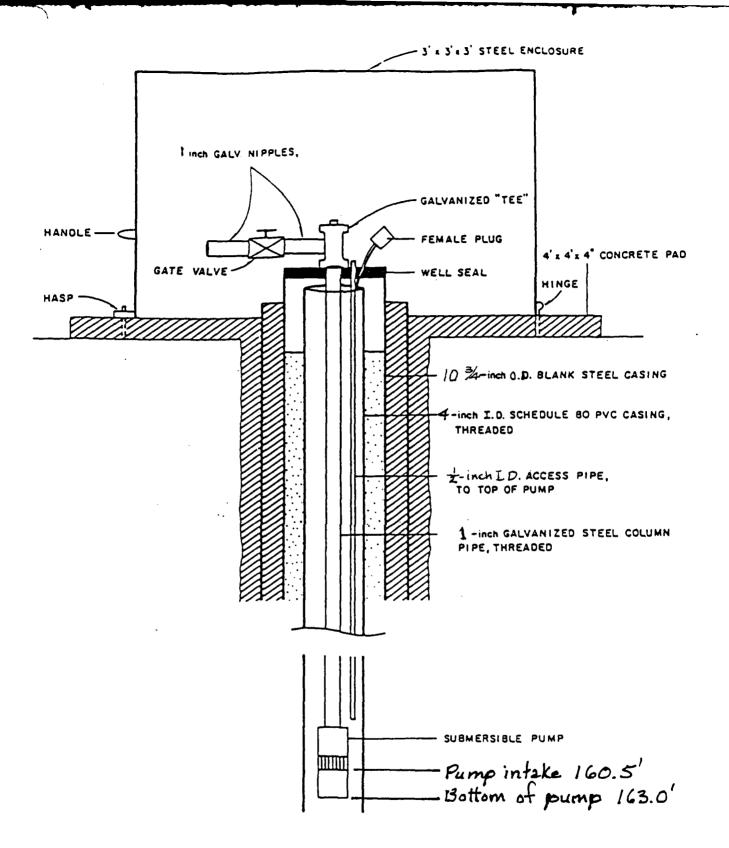
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Dett	LING LO	6	SMD PANISTON	HISTALL		Fort Wo	-	SHEET OF 3	SHEETS	
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				17. ELE	VATION TO			- L HAIL- B	<u></u>	
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Hole No. P-13(m) ext. ALL VIEW of 2 SHEETS DRILLING LOS SYD Ft Worth au/e M. MEE AND TYPE OF SIT Paluxy Aquifer Pollution Investigation diameter or Station Eir Force plant #4. 2. HANUFACTURER'S DESIGNATION OF DRILL USCE Failing 1500 12. TOTAL NO. OF SHOP OLE HO. (As al P-13(m)exstension SER CORE BOXES HAME OF DRILLER IL ELEVATION GROUND WATER To be determined Brewer/Merva ST ART EG DIRECTION OF HOLE 25 July 86 21 July 86 VERTICAL MINCLINED 17. ELEVATION TOP OF HOLE G37.83 . THICKNESS OF OVERBURDEN 14. 16. TOTAL CORE RECOVERY FOR SORIHE DEPTH DRILLED INTO ROCK 153,8 18. BIGHATURE OF INSPECTED MVey S. TOTAL DEPTH OF HOLE 167.8 CLASHFICATION OF NATERIALS ELEVATION DEPTH LEGENC Drilling 110.0 to 167.7 P-13(m) previously SANDSTONE - Paluxy Fm. drilled 16 dec 85 to mostly weak to non cemente 3 Jan 86 to 110' (drill some scattered weak to moderate cementation, fine log available). Hole has grout grained, light grey, thin up to 80.2 within metal casing Plug from 52.2 to 52.8. lignite seams scattered throughout, silty and shaley with numerous thin seams throughout. 84.2 to 92.3' - 9 7/8" rockbit - refusal on a metal plug installed -, ÷ with grout. 92.3 to 92.0' - 6" diamond core. 92.3 to 167.8' - 9 7/8" 120 167.7 to 167.8 rockbit. _ -- -SHALE - greenish grey to Hole was gamma logged (natural) and well monwhite. itoring casing installed after drilling. Well Installation TD = 167.8Bottom of pump = 163.0' Pump intake = 160.5' " pvc pipe. connects pump to surface and 130. filter material placed around screep. A 5' sump placed below pump and 20' of .010 screen placed immedfately above pump. Samples Two samples taken at 140_ 167.8'. One vial of drill fluid and one vial of cuttings with distilled water added to fill vois within vial. Note: Robert MCVey pre-sent only during drilling portion, ie, 84.2 to 167.8'. Gerald Schoonover present for inspection during well installation.and logging.

Hele Ne. P-13(m)ext.

DRILLING LOG	SVD	HETALLATION Ft W	orth		OF 2 SHEETS
1. PROJECT Paluxy Aquifer, AF	Plant #4	M. SIZE AND TYPE	E OF SIT	SHOWN (750 - 100)	
Z. LOCATION (Conditions or 3					
1 DBILLING AGENCY		12 MANUFACTUR	ers design	HATION OF BAILL	
4. HOLE NO. (As about on door and Me manhor)	ma tido!	13. TOTAL NO. OF	OVER-	DISTURBED	UNDISTURGED
L NAME OF DRILLER	P-13(m)exatension	IL TOTAL NUMBE	R CORE DO)XES	
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6. DIRECTION OF HOLE	DES. FROM VERT.	IL DATE HOLE	RA TE	CON	PLETED
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9. TOTAL DEPTH OF HOLE	167.8'			KARAN MOV	
ELEVATION DEPTH LEGENC	CLASSIFICATION OF MATERIA	S CORE RECOV- ERY	SAMPLE NO.	REMAR! (Delling time, mater mediaring, etc., i)	loca, depth of I oldrillocati
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MONITOR WELL P-13(M)

Mole No. 8A4C - 83

Dest	LING LO		(VISION	INSTALI	-	r h		OF I SHEETS	1	
I. PROJECT			SWD		NOT WOT		ell auger 4th		1	
Palux	y Aqui	fer Po	llution Investigation	11. DAY	UN FOR E	EVATION	HIGHWATER _ HEL	OFE	1	
2. LOCATION	d /Coardin	10100 or 3 1	ation)			***			J	
DRILLING	AGENCY	rce Pi	ant #4)	12. MANUFACTURER'S DESIGNATION OF ORILL						
USCE-C				Failing 1500						
4. HOLE NO.	(As show	-	ing title	- ĐƯÀ	DEN SAMP	LES TAKE	11	0]	
E HAME OF	DRILLER		: 8A4C-83	14. TOT	AL NUMBE	R CORE	OXES 1]	
	Brew			18. ELE	VATION G	ROUND WA	TER ***		1	
& DIRECTIO				M. DAT	E HOLE	i	•	LETED	1	
- WERTI	CAL .	INCLINE	DEG. FROM VERT.				Jul 85	11 Jul 85	┨	
7. THICKNES	S OF OVE	ERBURDE	32.0	$\overline{}$	VATION TO				1	
e. DEPTH DE	HLLED I	TO ROC			AL CORE		Y FOR BORING	39%	┨	
9. TOTAL DE	EPTH OF	HOLE	39.0		/	an	dy Mi	who .	ł	
ELEVATION	0.5574	LEGENO	CLASSIFICATION OF MATERIA		1 CORE	BOX OR SAMPLE HO.	(Drilling time, water	ers	1	
•	500	l	(Description)		ERY	NO.	treathering, etc.,	er loon, dopth of if eignificant	l	
	•	-	 		 				士	
i	=	1	0.0 to 0.6'		1		***		E	
ì	l <u> </u>	ł	ASPHALT		l		l. Drilled		Ł	
ł .	=		133.130.		1	l A		ater level	E	
] =	}	0.6' to 1.1']	, '` !	was 26.6'	After comple	F	
i	_	1	BASE MATERIAL			<u> </u>	of hole,	•	F	
]	=	1	j		ļ			hr check-	F	
[=	Į	1.1' to 19.5'		!	13	level was		F	
		;	CLAY:		İ				F	
	=	1	1.1' to 7.0' - med:		[E	
1		1	plas ticity, tan-bro		1		2. JARS:		上	
[1	medium stiff, moist		L	l C I	A. 1.1 to B. 4.0 to		E	
<u> </u>	=	ł	calcareous with scaline nodules.	ittere	f		C. 7.0 to		Е	
1 1	10	}	Ĭ		ł	<u> </u>	D. 10.0 t		F	
	~ ¬	ł	7.0' to 19.5' - lo				E. 13.0 t		F	
1 1	-		medium plasticity,		1	D	F. 16.0 t	o 19.5	F	
			medium stiff, moist calcareous, slight	-			G. 19.5 t		F	
} .		,	silty.	• 9]		H. 23.0 t		F	
l 1]				I. 26.0 t		E	
)	_ =	j	19.5' to 32.0'		1) E	J. 29.0 t K. 31.0 t		E	
1	╛		GRAVEL, dense, well		ĺ	[. 1	x. 31.0 t	0 32.0	E	
		İ	graded (fine to med		ļ	-	1		E	
i i			tan, moist, sandy,		ł	i i	3. Drilling	methods:	F	
			Borders on a grave	lly		F	0.0 to 32	.0 auger	F	
i	\exists		clay.		ł	l '		2.5 -rockbit		
	7		32.0 to 39.0'				32.5 to 3	9.0 - 4" cor	F	
	20 📑		LIMESTONE (Walnut fr	a)					二	
1	~ 7		32.0 to 38.1 -mode				/ After he	iling, hole	F	
	7		hard, dark gray, for	-		G	was backf	-	F	
1	\exists		ferous, dark gray, ca		Ļ			h neat cemen	Ł	
! !	⇉		ous clay matrix.		j	 	grout.		E	
1					ł				上	
	⇉		38.1 to 38.4-modera			Н	C 17-2	mnlas:	E	
]]	⇉		hard, gray, fossilife	erous,	1	'	5. Water sa	mhrs2:	E	
}	\dashv		clayey.		j	J -			E	
1	Ⅎ		38.4' to 38.6'-clay	/ seam	Ļ	1			E	
j i		İ	soft, tan-gray, sandy		}	I			F	
[\exists	l	fossiliferous.		[F	
	3	·	30 (1				F	
!	30		38.6 to 39.0-modera		Ĺ	1 5			F	
	⊣		hard, gray, fossil: clayey.	Lierou	В,				F	
1	7		Clayey.		l	K			F	
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j j			1			<u> </u>	}		F	
FMG BOOM	10.31		US EDITIONS ARE DESCRIPTE.		PROJECT		L	HOLE NO.		
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PAILEY AQUATE Pollution Investigation ALE FORCE Plant 80.47 (C. D.) 277 8.0 THE ANAPOPT PLANT 80.47 (C. D.) 278 8.0 THE ANAPOPT PLANT 80.47 (C. D.) 278 8.0 THE ANAPOPT PLANT 80.47 (C. D.) 278 8.0 THE ANAPOPT PLANT 80.47 (C. D.) 278 8.0 THE ANAPOPT PLANT 80.47 (C. D.) 278 8.0 THE ANAPOPT PLANT 80.47 (C. D.) 278 8.0 THE ANAPOPT PLANT 80.47 (C. D.) 278 8.0 THE ANAPOPT PLANT 80.47 (C. D.) 278 8.0 THE ANAPOPT PLANT 80.47 (C. D.) 278 8.0 THE ANAPOPT PLANT 80.47 (C. D.) 278 8.0 THE ANAPOPT PLANT 80.47 (C. D.) 278 8.0 THE ANAPOPT PLANT 80.47 (C. D.) 278 8.0 THE ANAPOPT PLANT 80.47 (C. D.) 278 8.0 THE ANAPOPT PLANT 80.47 (C. D.) 278 9.0								Hale No.5	MAC - RA
PRINTY Aquifer Polintion Investigation PRINTY Aquifer Polintion Investigation OSCEN OSCEN OSCEND (19 Annual 10 OSCEN) Frever Section Control of Cont	Dett	ING I C							SHEET
PAINTY AQUIFE Polition Investigation SCHOOL STATE 18.07 (C. D.) 411 8.0 DERIVATION TO STATE 18.07 (C. D.) 241 8.0 DERIVATION TO STATE 18.00 DETITE 18.00 DETITE 18.00 DETITE 18.00 DETITE 18.00 DETITE 18.00 DETITE 18.00 DETITE 18.00 DETITE 18.00 DETITE 18.00 DETIT	I. PROJECT		~	310				10" Anger/6"	
Delicition Assertion and advantage of the State of the St	Paluxy	Aquif	er Pol	lution Investigation	11. DAY	A POR EL	EVATION	SHOWN (TOW or MAN	,
SOULT SERVICE STATES AND ASSESSED STATES OF THE SERVICE STATES OF	L LOCATION	ce Pis	nt No.	4 (G. D.) 471 N. of	12. MAME	PACTURE	ER'S DESIG	SNATION OF ORILL	
SAME OF CHILLES 17 O	2 DRILLING	AGENCY						XO	
SAME of SMILES THE FORM NUMBERS OF SAME SAME SAME SAME SAME SAME SAME SAME	4. HOLE NO.	(As show			13. TOT			DISTURGED	
Described Desc	and #10 nu				14 TOT	AL NUMBE	n cone		· · · · · · · · · · · · · · · · · · ·
Described of sold (Constitution of sold sold sold sold sold sold sold sold	S. NAME OF	DRILLER		Brower	IS ELE	ATION G	ROUND WA	TER See commer	t 1
TVELLENGE OF CONSTRUCTION OFFIN ORDITATION OF SALVERIALS OFF	S. DIRECTIO	H OF HOL	. «				STA	RTED	OMPLETED
THURCHESS OF OUTSIDENESS OF CONTRIBUTES OF THE PARTY OF T	TVERTI	CAL []	HCLINEC	DES. PROM VERT.					
SCHOOL STRUCKS ONLY EVALUATION OF WOLK CAMENICATION OF VERTICALS CAMENIC	7. THICKNES	S OF OVE	RBURDE						
LEVATION DEFIN LEGEND CLASSIFICATION OF WATERIALS \$1000 \$0000 \$00000 \$000000 \$000000 \$000000 \$0000000 \$00000000	. DEPTH DE	HLLED H	ITO ROCE	00.51		ATURE OF	MISPECT	OR/	
O.0' to 0.6' Asphalt O.6' to 1.4' O.6' to 1.4' Gravel Base 1.4' to 17.4' CLAY: 1.4' to 17.4' CLAY: 1.4' to 17.0': medius to high plasticity; black; stiff; moist; calcareous. 7.0' to 11.0': high plasticity; tan - brown; very stiff: - bard; moist; calcareous. 1.1.0' to 1.1.0': high plasticity; reddish brown; very stiff; moist; calcareous. 1.1.0' to 1.1.0': medius to high plasticity; tan - brown; very stiff; moist; calcareous. 1.1.0' to 1.1.0': high plasticity; tan - brown; very stiff; moist; calcareous. 1.1.0' to 1.1.0': medius to high plasticity; tan - brown; very stiff; moist; calcareous. 1.1.0' to 1.1.0': medius to high plasticity; tan - brown; very stiff; moist; calcareous. 2. Jar Samples A. 1.4 - 4.0 C. 7.0 - 9.0	. TOTAL O	EPTH OF	HOLE		<u> </u>		<u> </u>		
O.0' to 0.6' Asphalt O.6' to 1.4' O.6' to 1.4' Gravel Base 1.4' to 17.4' CLAY: 1.4' to 17.4' CLAY: 1.4' to 17.0': medius to high plasticity; black; stiff; moist; calcareous. 7.0' to 11.0': high plasticity; tan - brown; very stiff: - bard; moist; calcareous. 1.1.0' to 1.1.0': high plasticity; reddish brown; very stiff; moist; calcareous. 1.1.0' to 1.1.0': medius to high plasticity; tan - brown; very stiff; moist; calcareous. 1.1.0' to 1.1.0': high plasticity; tan - brown; very stiff; moist; calcareous. 1.1.0' to 1.1.0': medius to high plasticity; tan - brown; very stiff; moist; calcareous. 1.1.0' to 1.1.0': medius to high plasticity; tan - brown; very stiff; moist; calcareous. 2. Jar Samples A. 1.4 - 4.0 C. 7.0 - 9.0	ELEVATION	DEPTH	LEGENO	CLASSIFICATION OF MATERIA	LS	RECOV	SAMPLE NO.	Drilling time, and	nKS or ison, dopth of if circuitions
24 hr. check — water level had dropped over night from ground leve to 27.0', caved to 57.5 he hole made to much water to bail dry. 1.4' to 17.4' CLAY: 1.4' to 7.0': medium to high plasticity; black; stiff; moist; calcareous. 10— 10— 10— 10— 10— 10— 10— 10	•	•							
Level had dropped over- Gravel Base		=		0.0' to 0.6'				1. Water Le	vel
Carel Base A Carel Base	ł] _=	!	<u>Asphalt</u>					
Gravel Base Gravel Base Cravel Base The hole made to much water to bail dry. The hole nade to much water to bail dry. 1014 0 34.8° 1015 1 33.2° 1016 2 32.1° 1017 3 32.1° 1018 4 33.8° 1018 4 33.8° 1018 4 33.8° 1018 4 33.8° 1018 4 33.8° 1018 4 33.8° 1018 4 33.8° 1018 4 33.8° 1018 4 33.8° 1018 4 33.8° 1018 4 33.8° 1018 4 33.8° 1018 2 22.7° 1018 4 33.8° 1018 4 31.8° 1018 2 32.1° 1018 4 33.8° 1018 4 33.8° 1018 2 32.1° 1018 4 33.8° 1018 4 33.8° 1018 4 33.8° 1018 4 34.8° 102.1 4.0° 1.4 4.0° 1.4 1.0° 1.4 4.0° 1.4 1.0° 1.4 20.0° 1.4 20.0° 1.4 20.0° 1.4 20.0° 1.2 20.0° 23.0° 4. 1.4 4.0° 1.4 1.0° 1.4 20.0° 1.4 20.0° 1.4 20.0° 1.2 20.0° 2. 3. 2. 3. 36.0° 2. 46.0° 2. 46.0° 2. 46.0° 2. 46.0° 2. 46.0° 2. 46.0° 2. 46.0° 2. 46.0° 2. 46.0° 2. 46.0° 2. 46.0° 2. 46.0° 2. 46.0° 2. 46.0° 2. 46.0° 2. 46.0		=		0 61 40 1 41			Δ :		
The hole made to much water to bail dry. 144' to 174' CLAY: 124' to 7.0': medium to high plasticity; black; stiff; moist; calcareous. 7.0' to 11.0': high plasticity; tan - brown; very stiff' - hard; moist; calcareous, with a few lime nodules from 9.0'; sandy. 100' to 14.0': medium plasticity; reddish brown; very stiff' moist; calcareous; with a few lime nodules from 9.0'; sandy. 11.0' to 14.0': medium plasticity; reddish brown; very stiff' moist; calcareous; with a few lime nodules from 9.0'; sandy. 200' The first moist; calcareous; silty. 21.10' to 17.4': low plasticity; tan; stiff; moist; calcareous; well graded (fine to medium gravel sizes and cobble sizes from 21.0'; clayey, sandy. 22. Dry Samples 23.0' to 23.0': low plasticity; tan; medium stiff - stiff; moist; calcareous; silty. 23.0' to 25.0': low plasticity; tan; medium stiff - stiff; moist; calcareous; silty. 25.0' to 29.0': medium plasticity; tan; medium stiff - stiff; moist; calcareous; silty. 25.0' to 29.0': medium plasticity; reddish brown; medium stiff - stiff; moist; calcareous; silty. 25.0' to 29.0': medium plasticity; reddish brown; medium stiff - stiff; moist; calcareous; silty. 26.0' to 29.0': medium plasticity; reddish brown; medium stiff - stiff; moist; calcareous; silty. 26.0' to 29.0': medium plasticity; tan; medium stiff - stiff; moist; calcareous; silty. 27.2'. Hole was casped off with premixed concrete.		=					~		
144' to 17.4' 1015 13.5; 2' 1016 2 32.7' 1017 3 32.1' 1018 4 31.2' 10.2' 11.0 11		=		Gravel Base				The hole m	ade to much
la4' to 174' CLAY: 1.4' to 7.0': medium to high plasticity; black; stiff; moist; calcarecus. 10 T.0' to 11.0': high plasticity; tan - brown; very stiff' - hard; moist; calcarecus, with a few lime nothles from 9.0'; sandy. 11.0' to 14.0': medium plasticity; reddish brown; very stiff; moist; calcarecus; very sandy. 20 11.0' to 17.4': low plasticity; tan; stiff; moist; calcarecus; well graded (fine to medium gravel sizes and cobble sizes from 21.0'g clayey, sandy. 25.0' to 50.0' CLAY: 25.0' to 25.0': low plasticity; tan; medium stiff - stiff; moist; calcarecus; silty. 25.0' to 25.0': low plasticity; tan; medium stiff - stiff; moist; calcarecus; silty. 26.0' to 29.0': medium plasticity; tan; medium stiff - stiff; moist; calcarecus; silty. 27.0' to 50.0' CLAY: 28.0' to 26.0': low plasticity; tan; medium stiff - stiff; moist; calcarecus; silty. 28.0' to 29.0': medium plasticity; tan; medium stiff - stiff; moist; calcarecus; silty. 29.0' to 29.0': medium plasticity; tan; medium stiff - stiff; moist; calcarecus; silty. 29.0' to 29.0': medium plasticity; tan; medium stiff - stiff; moist; calcarecus; silty. 29.0' to 29.0' medium plasticity; tan; stiff; moist; calcarecus; well graded (fine to medium gravel sizes and cobble sizes from 21.0'g clayey, sandy. 29.0' to 50.0' CLAY: 21.0' to 22.0' to 50.0' to 62.0' - 7 7/9" rock bit. 22.0' to 50.0' to 50.0' to 50.0' to 50.0' to 6	j	=	! !				_		
CLAY: 1-4' to 7.0': medium to high plasticity; black; stiff; moist; calcareous. 7.0' to 11.0': high plasticity; tan brown; very stiff' hard; moist; calcareous, with a few lime plasticity; reddish brown; very stiff; moist; calcareous; very stiff; moist; calcareous; very stiff; moist; calcareous; very stiff; moist; calcareous; very stiff; moist; calcareous; well graded (fine to medium gravel sizes and cobble sizes from 27.0'g clayey, sandy. 23.0' to 25.0' to 50.0' CLAY: 25.0' to 29.0'; low plasticity; tan; medium stiff - stiff; moist; calcareous; silty. 26.0' to 29.0'; low plasticity; tan; medium stiff - stiff; moist; calcareous; silty. 27.2' moist calcareous; silty. 28.0' to 29.0'; low plasticity; tan; medium stiff - stiff; moist; calcareous; silty. 28.0' to 29.0'; low plasticity; reddish brown; medium stiff - stiff; moist; calcareous; silty.	ł			1.4' to 17.4'			8	1	
10 10 10 10 10 10 10 10 10 10				r 			<u> </u>	1016 2	32.7'
high plasticity; black; stiff; moist; calcareous. 7.0' to 11.0'; high plasticity; tan - brown; very stiff - hard; moist; calcareous, with a few lime nodules from 9.0'; sandy. 11.0' to 14.0'; medium plasticity; reddish brown; very stiff; moist; calcareous; very sandy. 11.0' to 14.0'; medium plasticity; reddish brown; very stiff; moist; calcareous; very sandy. 14.0' to 17.4'; low plasticity; tan; stiff; moist; calcareous; silty. 17.4' to 23.0' CRAYEL: dense; tan; moist; calcareous; silty. 17.50 to 50.0' CLAY: 23.0' to 50.0' CLAY: 25.0' to 50.0' CLAY: 26.0' to 29.0'; medium plasticity; reddish brown; medium stiff - stiff; moist; calcareous; silty. 26.0' to 29.0'; medium plasticity; reddish brown; medium stiff - stiff; moist; calcareous; silty. 26.0' to 29.0'; medium plasticity; reddish brown; medium stiff - stiff; moist; calcareous; silty. 27.2' 28. Jar Samples A. 1.4 - 4.0 R. 4.0 - 7.0 C. 7.0 - 9.0 D. 9.0 - 11.0 E. 11.0 - 17.0 C. 17.0 - 17.4 E. 17.4 - 20.0 I. 20.0 - 23.0 I. 20.0 - 23.0 I. 20.0 - 23.0 I. 20.0 - 23.0 I. 20.0 - 23.0 I. 26.0 - 29.0 I. 20.0 - 23.0 I. 26.0 - 29	ſ						_		
stiff; moist; calcareous. 7.0' to 11.0': high plasticity; tan - brown; very stiff' - bard; moist; calcareous, with a few lime nodules from 9.0'; sandy. 11.0' to 14.0': medium plasticity; reddish brown; very stiff; moist; calcareous; silty. 11.0' to 17.4': low plasticity; tan; stiff; moist; calcareous; silty. 17.4' to 23.0' GRAYEL: dense; tan; moist; calcalcareous; well graded (fine to medium gravel sizes), some coarse gravel sizes and cobble sizes from 21.0'g clayey, sandy. 20. 21.0' to 50.0' CLAY: 23.0' to 50.0' CLAY: 25.0' to 50.0' CLAY: 25.0' to 50.0' CLAY: 25.0' to 50.0' CLAY: 26.0' to 29.0': medium plasticity; tan; medium stiff' - stiff; moist; calcareous; silty. 26.0' to 29.0': medium plasticity; reddish brown; medium stiff' - stiff; moist; calcareous; silty. 26.0' to 29.0': medium plasticity; reddish brown; medium stiff' - stiff; moist; calcareous; silty. 27. Tar Samples A. 4.0 - 7.0 B. 4.0 - 7.0 C. 7.0 - 9.0 D. 9.0 - 11.0 E. 11.0 - 14.0 F. 14.0 - 17.0 G. 17.0 - 17.4 E. 11.0 - 14.0 F. 14.0 - 17.0 G. 17.0 - 17.4 E. 11.0 - 14.0 F. 14.0 - 17.0 G. 17.0 - 17.0 G. 17.0 - 17.4 E. 11.0' to 40.0 - 23.0 L. 26.0 E. 14.0 - 29.0 L. 29.0 - 32.0 L. 29.0 - 35.0 L. 29.0 - 35.0 L. 29.0 - 35.0 L. 29.0 - 36.0 O. 38.0 - 43.0 P. 45.0 - 46.0 Q. 46.0 - 48.0 O.0' to 41.0' - 10'' amger. 48.0' to 58.0' - 4'' core barrel. 58.0' to 62.0' - 7 7/8' rock bit. 9 bags of neat grout was poured into the hole and allowed to set for 20 hrs. To ef groat is at 27.2'. Role was backfilled with cuttings and left-over cuttings were placed in cloth sample bags the top 0.6' of the hole was capped off vith premixed concrete.		=						1016 4	21.8'
Too' to 11.0': high plasticity; tan - brown; very stiff - bard; moist; calcareous, with a few lime nodules from 9.0'; sandy. 11.0' to 14.0': medium plasticity; reddish brown; very stiff; moist; calcareous; very sandy. 20 11.0' to 14.0': medium plasticity; reddish brown; very stiff; moist; calcareous; silty. 20 14.0' to 17.4': low plasticity; tan; stiff; moist; calcareous; silty. 21.1' to 23.0' CRAVEL; dense; tan; moist; calcareous; silty. 22.1' to 50.0' CLAY: 23.0' to 50.0' CLAY: 25.0' to 26.0': low plasticity; tan; medium stiff - stiff; moist; calcareous; silty. 26.0' to 29.0': medium plasticity; tan; medium stiff - stiff; moist; calcareous; silty. 26.0' to 29.0': medium plasticity; tan; medium stiff - stiff; moist; calcareous; silty. 26.0' to 29.0': medium plasticity; reddish brown; medium stiff - stiff; moist; calcareous; silty. 27.0' to 50.0' medium plasticity; reddish brown; medium stiff - stiff; moist; calcareous; silty. 28.0' to 50.0' of the hole was capped off vith premixed concrete.		۱., ⊐						2. Jar Samp	es
7.0' to 11.0': high plasticity; tan - brown; very stiff - hard; moist; calcareous, with a few lime nodules from 9.0'; sandy. 11.0' to 14.0': medium plasticity; reddish brown; very stiff; moist; calcareous; very sandy. 20 11.0' to 14.0': medium plasticity; reddish brown; very stiff; moist; calcareous; very sandy. 20 14.0' to 17.4': low plasticity; tan; stiff; moist; calcareous; silty. CRAVEL; dense; tan; moist; calcareous; silty. CRAVEL; dense; tan; moist; calcareous; silty. 23.0' to 50.0' CLAY: 23.0' to 50.0' CLAY: 25.0' to 50.0' CLAY: 26.0° to 29.0': medium plasticity; tan; medium stiff - stiff; moist; calcareous; silty. 26.0° to 29.0': medium plasticity; reddish brown; medium stiff - stiff; moist; calcareous; silty. 26.0° to 29.0': medium plasticity; reddish brown; medium stiff - stiff; moist; calcareous; silty. 27.0' to 50.0' medium plasticity; reddish brown; medium stiff - stiff; moist; calcareous; silty. 28.0' to 50.0' of the hole was capped off vith premixed concrete.		10		,			D I		
plasticity; tan - brown; very stiff' - bard; moist; calcareous, with a few lime nodules from 9.0'; sandy. 11.0' to 14.0': medium plasticity; reddish brown very stiff; moist; calcareous; stiff; moist; calcareous; silty. 17.4' to 23.0' CRAVEL: dense; tan; moist; calcareous; well graded (fine to medium gravel sizes), some coarse gravel sizes and cobble sizes from 21.0'g clayey, sandy. 23.0' to 26.0': CLAY: 25.0' to 26.0': CLAY: 25.0' to 26.0': CLAY: 25.0' to 26.0': CLAY: 25.0' to 26.0': CLAY: 25.0' to 26.0': CLAY: C	ł	=		7 01 +0 11 010 24			<u> </u>		-
very stiff: hard; moist; calcareous, with a few lime nodmles from 9.0'; sandy. 11.0' to 14.0': medium plasticity; reddish brown: very stiff; moist; calcareous; very sandy. 14.0' to 17.4': low plasticity; tan; stiff; moist; calcareous; silty. 17.4' to 23.0'							_		
lime nothles from 9.0'; sandy. C. 17.0 - 17.4 17.4 - 20.0	{	=) E		
sandy. Internation Intern			'						
Il.0' to 14.0': medium plasticity; reddish brown very stiff; moist; cal- careous; very sandy. 20 14.0' to 17.4': low plasticity; tan; stiff; moist; calcareous; silty. 17.4' to 23.0' GRAVEL: dense; tan; moist; calcareous; well graded (fine to medium gravel sizes), some coarse gravel sizes and cobble sizes from 21.0'g clayey, sandy. 25.0' to 50.0' CLAY: 25.0' to 50.0' CLAY: 25.0' to 29.0': medium plasticity; tan; medium stiff - stiff; moist; calcareous; silty. 26.0' to 29.0': medium plasticity; reddish brown; medium stiff - stiff; moist; calcareous; silty.	,	=	ļ ,	,	•0';]		
11.0' to 14.0': medium plasticity; reddish brown: very stiff; moist; calcareous; very sandy. 14.0' to 17.4': low plasticity; tan; stiff; moist; calcareous; silty. 17.4' to 23.0' 17.4' to 48.0' - 6" 17.4' to 48.0' to 48.0' to 48.0' to 48.0' to 48.0' to 48.0' t							F	I. 20.0 -	23.0
plasticity; reddish brown very stiff; moist; cal- careous; very sandy. 20 14.0' to 17.4': low plasticity; tan; stiff; moist; calcareous; silty. 17.4' to 23.0' CRAVEL: dense; tan; moist; calcareous; well graded (fine to medium gravel sizes), some coarse gravel sizes and cobble sizes from 21.0'g clayey, sandy. 23.0' to 50.0' CLAY: 23.0' to 50.0' CLAY: 23.0' to 26.0': low plasticity; tan; medium stiff = stiff; moist; calcareous; silty. 26.0' to 29.0': medium plasticity; reddish brown; medium stiff - stiff; moist; calcareous; silty. L. 29.0 - 32.0 M. 32.0 - 35.0 M. 32.0 - 35.0 M. 32.0 - 35.0 N. 32.0 - 33.0 P. 45.0 - 46.0 Q. 46.0 - 48.0 V. 41.0' to 48.0' - 6" amger. 48.0' to 58.0' - 4" core barrel. 58.0' to 62.0' - 7 7/8" rock bit. 9 bags of neat grout was soured into the hole and allowed to set for 20 hrs. Top of grout is at 27.2'. Hole was backfilled with cuttings and left- over cuttings were place over cuttings were place ded in cloth sample bags The top 0.6' of the hole was capped off with premixed concrete.]								
very stiff; moist; calcareous; very sandy. 14.0' to 17.4': low plasticity; tan; stiff; moist; calcareous; silty. 17.4' to 23.0' GRAVEL: dense; tan; moist; calcareous; vell graded (fine to medium gravel sizes), some coarse gravel sizes and cobble sizes from 21.0'; clayey, sandy. 23.0' to 50.0' CLAY: 23.0' to 50.0' CLAY: 25.0' to 29.0': medium plasticity; tan; medium plasticity; reddiah brown; medium stiff stiff; moist; calcareous; silty. 26.0'' to 29.0': medium plasticity; reddiah brown; medium stiff stiff; moist; calcareous; silty.		3					5		, -
carsons; very sandy. Carsons; very sandy. A						•			
14.0' to 17.4': low plasticity; tan; stiff; moist; calcareous; silty. 17.4' to 23.0' CRAVEL: dense; tan; moist; calcareous; well graded (fine to medium gravel sizes), some coarse gravel sizes and cobble sizes from 21.0'g clayey, sandy. 23.0' to 50.0' CLAY: Stiff - stiff; moist; calcareous; silty. 26.0' to 29.0': medium plasticity; reddish brown; medium stiff - stiff; moist; calcareous; silty. P. 43.0 - 46.0 Q. 46.0 - 48.0 Q. 46.0 - 48.0 A fulling Methods (0.0' to 41.0' - 10" anger. Set 8" steel casing to 41.0' to 48.0' - 6" anger. 48.0' to 58.0' - 4" core barrel. 58.0' to 62.0' - 7 7/8" rook bit. 9 bags of neat grout was poured into the hole and allowed to set for 20 hrs. Top of grout is at 27.2'. Hole was backfilled with cuttings and left over cuttings were placed in cloth sample bags the top 0.6' of the hole was capped off with premixed concrete.		=					/+		
14.0' to 17.4': low plasticity; tan; stiff; moist; calcareous; silty. 17.4' to 23.0' CRAVEL: dense; tan; moist; calcareous; well graded (fine to medium gravel sizes), some coarse gravel sizes and cobble sizes from 21.0'; clayey, sandy. 23.0' to 50.0' CLAY: 23.0' to 50.0' CLAY: 23.0' to 26.0': low plasticity; tan; medium stiff - stiff; moist; calcareous; silty. 26.0'' to 29.0': medium plasticity; reddish brown; medium stiff - stiff; moist; calcareous; silty.		20					<u> </u>		
plasticity; tan; stiff; moist; calcareous; silty. 17.4' to 23.0' CRAVEL: dense; tan; moist; calcareous; well graded (fine to medium gravel sizes), some coarse gravel sizes and cobble sizes from 21.0'g clayey, sandy. CLAY: 23.0' to 50.0' CLAY: 23.0' to 26.0': low plasticity; tan; medium stiff - stiff; moist; calcareous; silty. 26.0'' to 29.0': medium plasticity; reddish brown; medium stiff - stiff; moist; calcareous; silty. 25.0'' to 29.0': medium plasticity; reddish brown; medium stiff - stiff; moist; calcareous; silty.	İ	=	!	14.0' to 17.4': low			i		
17.4' to 23.0' GRAVEL: dense; tan; moist; calcareous; well graded (fine to medium gravel sizes), some coarse gravel sizes and cobble sizes from 21.0'; clayey, sandy. CLAY: CLAY: 23.0' to 50.0' CLAY: 23.0' to 50.0': low plasticity; tan; medium stiff - stiff; moist; calcareous; silty. 26.0'' to 29.0': medium plasticity; reddish brown; medium stiff - stiff; moist; calcareous; silty. O.0'' to 41.0' - 10'' anger. Set 8" steel casing to 41.0'. 41.0' to 48.0' - 6" anger. 58.0' to 58.0' - 4" core barrel. 58.0' to 58.0' - 7 7/8' rock bit. 9 bags of neat grout was poured into the hole and allowed to set for 20 hrs. Top of grout is at 27.2'. Hole was backfilled with cuttings and left-over cuttings were placed in cloth sample bags The top 0.6' of the hole was capped off with premixed concrete.	İ	Ξ		plasticity; tan; st	iff;		L		
23.0' to 50.0' CLAY: 23.0' to 26.0': low plasticity; tan; medium stiff - stiff; moist; calcareous; silty. 26.0'' to 29.0': medium plasticity; reddish brown; medium stiff - stiff; moist; calcareous; silty.	Í	∵ ⊐		moist; calcareous;	silty.			3. Drilling	<u>Methods</u>
23.0' to 50.0' CLAY: 23.0' to 26.0': low plasticity; tan; medium stiff - stiff; moist; calcareous; silty. 26.0'' to 29.0': medium plasticity; reddish brown; medium stiff - stiff; moist; calcareous; silty.		= =					,		,0° - 10°
23.0' to 50.0' CLAY: 23.0' to 26.0': low plasticity; tan; medium stiff - stiff; moist; calcareous; silty. 26.0'' to 29.0': medium plasticity; reddish brown; medium stiff - stiff; moist; calcareous; silty.	1			17.4' to 23.0'			5		l casing to
23.0' to 50.0' CLAY: 23.0' to 26.0': low plasticity; tan; medium stiff - stiff; moist; calcareous; silty. 26.0'' to 29.0': medium plasticity; reddish brown; medium stiff - stiff; moist; calcareous; silty.		\exists					1	41.0'.	
23.0' to 50.0' CLAY: 23.0' to 26.0': low plasticity; tan; medium stiff - stiff; moist; calcareous; silty. 26.0'' to 29.0': medium plasticity; reddish brown; medium stiff - stiff; moist; calcareous; silty.	ļ	-		calcareous; well grad	ed		<u> </u>		0.0° - 6°
23.0' to 50.0' CLAY: 23.0' to 26.0': low plasticity; tan; medium stiff - stiff; moist; calcareous; silty. 26.0'' to 29.0': medium plasticity; reddish brown; medium stiff - stiff; moist; calcareous; silty.		3					ν ·		1-01 - 41
23.0' to 50.0' CLAY: 23.0' to 26.0': low plasticity; tan; medium stiff - stiff; moist; calcareous; silty. 26.0'' to 29.0': medium plasticity; reddish brown; medium stiff - stiff; moist; calcareous; silty.	J	=					\ ^		
23.0' to 50.0' CLAY: 23.0' to 26.0': low plasticity; tan; medium stiff - stiff; moist; calcareous; silty. 26.0'' to 29.0': medium plasticity; reddish brown; medium stiff - stiff; moist; calcareous; silty.	Ì	╡			- p r				.0' - 7 7/8°
23.0' to 50.0' CLAY: 23.0' to 26.0': low plasticity; tan; medium stiff - stiff; moist; calcareous; silty. 26.0'' to 29.0': medium plasticity; reddish brown; medium stiff - stiff; moist; calcareous; silty.	}	<u>,,</u>					,		est mm.
CLAY: CLAY:		~-	1	23.0' to 50.0'			L		
23.0° to 26.0°: low plasticity; tan; medium stiff - stiff; moist; calcareous; silty. 26.0° to 29.0°: medium plasticity; reddish brown; medium stiff - stiff; moist; calcareous; silty. 27.2°. Hole was backfilled with cuttings and left-over cuttings were place ed in cloth sample bags The top 0.6° of the hole was capped off with premixed concrete.	1	\exists						hole and al	lowed to set
brown; medium stiff - stiff; moist; calcareous; silty.	-						<u> </u>	for 20 hrs.	
brown; medium stiff - stiff; moist; calcareous; silty.	ļ								T IS AT
brown; medium stiff - stiff; moist; calcareous; silty.	i	J					"	1 _ ·	ckfilled
brown; medium stiff - stiff; moist; calcareous; silty.	}	=			- 7			with cuttin	gs and left-
brown; medium stiff - stiff; moist; calcareous; silty.	ł	7						over cutting	gs vere plac
brown; medium stiff - stiff; moist; calcareous; silty.	}	1		26_0# to 29_01. ==4	ins.		N		
brown; medium stiff - stiff; moist; calcareous; silty.	}	\exists					1	hole was ca	pped off
silty.			'	brown; medium stiff	-			with premix	ed concrete.
	į				recus;		0		
IG PORM 10.24	NO 800::			442414			<u> </u>	L	

ENG FORM 1836 PREVIOUS EDITIONS ARE OSSOLETE. Paluxy Aquifer Pollution: Invest.

HOLE NO. 844C - 84

Hele No. 844C - 84

	LING LO	E	SWD		ort Wor			OF 2 SHEETS
Paluxy	A ₀ uife	r Poll	ution Investigation	10. SIZE	AND TYPE	EVATION	10" Augor/6"	Auger
LOCATION	(Coordin	atoc or St	4 149)	1			NATION OF DRILL	
DRILLING	AGENCY			12. MAN		g 1500	MATION OF BRILL	
HOLE NO.	(As show		USCEC	13. TOT	AL NO. OF		H 17	CBERUTEIGNU
HAME OF			8A4C - 64	14. TOT	AL NUMBE	R CORE B	OXES	
MARK UP	ORICLEN		irever	IL ELE	ATION G	NOUND WA	TER See comm	ent 1
DIRECTIO				IS. DAT	_	STA	NTED	OMPLETED
X VERTI				17. ELE	ATION TO			14 July 85
DEPTH DE			707				FOR BORING	
TOTAL DE			62.0	19. SIGN	ATURE OF	INSPECT	Randy	Fredul
EVATION	DEPTH	LEGEND	CLASSIFICATION OF MATERIA	LS	S CORE	BOX OR SAMPLE NO.	(Drilling (ma.	ARKS
			(Deceription)		ERY	NO.	watering, etc	Mar less, depth of L. If significant)
			49.0					
	=		23.0' to 50.0'			0		
	\equiv		CLAY:			l i		
			29.0' to 46.0': lor					
	==		plasticity; tan - r brown; medium stiff		L .	ا ہ		
			moist; calcareous;]		
						 -		
	=		46.0' to 48.0': med	ium to		2		
	-]		high plasticity; re	ddish		├		
			brown; very stiff; calcareous.	moist				
	50							
	\exists					[[
			48.0' to 61.5') [
			GRAVEL: determined fr	03				
	_=		small core sample and drilling action.	l 				
	1		diriting action.					
į								
			61.5' to 62.0'					
	=		Walnut Formation (?)					
			Determined from r	ock				
	\exists		bit cuttings.					
	60							
	=							
j			T.D. 62.0					
ļ	=====================================							
	\exists							
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	<u> </u>							
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	70 -			1				
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ĺ]							
	E							
	=							
	=							
G FORM	10.14		US EDITIONS ARE DESOLETE		PROJECT			HOLE NO

							Hole No. 844C - 85	
DRIL	LING LO		SVD	POT	ATION t Wort	h	SHEET OF 2 SHEETS	1
I. PROJECT				10. SIZE	AND TYP	OF BIT	10" Auger / 4" Carboloy	1
Latrita			lution Investigation	II. DAY	IN FOR E	EVATION	SHOWN (TEN - MEL)	1
_	Air P	orce P	lant No. 4	12. MAN	_		SHATION OF DRILL	1
		1	USCEC	13. 707	AL NO. OF DEM SAMP	Biling OVER-		┨
AND MO ME	(As also	-	8AAC - 85					4
. NAME OF	DRILLER		rever	IL ELE	AL HUMBE	R CORE I	oxes 1	่า
L DIRECTIO	N OF HO			H. DAT		STA	RTED COMPLETED	1
X VERTI	CAL	INCLINE	DES. FROM VERT.	<u> </u>	VATION TO			┨
. THICKNES							Y FOR BORING 92 %	1
. DEPTH DR			65.5	19. SIGN	ATURE OF	INSPECT	ander Mieleuh	
ELEVATION		1	CLASSIFICATION OF MATERIA	L.S	S CORE	BOX OR	REMARKS (Drilling time, mater loos, depth of	1
•	b	•	(Dooartpeisen)		ERY	SAMPLE NO.	readering, etc., if eignificant)	
	_		0.0' to 0.4'					E
	=	1	Asphalt]	A	1. Water Level	F
	Ξ		we have a				24 hr. check with a hole depth of 55.0' -	E
	=		0 41 +0 52 01		•	8	water at 24.1' and	F
	10		0.4' to 52.0'			-	caved below 37.7'.	E
	=		CLAY:			1 c		þ
	Ξ		0.4' to 4.3': high plasticity; red bro			_	2. <u>Jar Samples</u>	E
	=		dark red brown; ver	y stif	r;		A. 0.4 - 2.4 B. 2.4 - 4.3	þ
	Ξ		damp; calcareous; s	andy.]	D	C. 4.3 - 7.0	E
	., =						D. 7.0 - 9.0 E. 9.0 - 14.0	þ
	10 —		4.3" to 9.0': meding high plasticity; re		n.		F. 14.0 - 17.0	E
	=		stiff - very stiff;	damp;		Ε	G. 17.0 - 20.0 E. 20.0 - 23.0	E
			calcareous, with li		ier		E. 20.0 - 23.0 I. 23.0 - 26.0	F
	Ξ		sandy.	,			J. 26.0 - 29.0	E
							K. 29.0 = 32.0 L. 32.0 = 36.0	F
Í	Ξ		9.0' to 17.0': low			بَر ا	M. 36.0 - 39.0	E
	=		<pre>plasticity; tan - re brown; medium stiff</pre>			′	W. 39.0 = 42.0 V. 42.0 = 45.0	F
			stiff; moist; calcar				P. 45.0 - 48.0	E
			silty.	,		6	Q. 48.0 - 52.0 R. 52.0 - 55.0	F
						9	S. 55.0 - 59.0	E
İ	20 —		17.0' to 29.0': med: high plasticity, with			 		F
l			low plasticity zone	from		Н	5. <u>Drilling Methods</u>	E
	_		20.0' to 23.0'; tan;		130	′′	0.0' to 59.0' - 10"	E
1	Ξ		stiff - stiff; moist careous; silty from				auger. Set 8" steel casing to	E
	_		•				59.0°. Had a hard time	ıЕ
ļ	Ξ		29.0' to 32.0': his	zh.		I	setting due to caving and sand zone above the	Ė
	1		plasticity; red brow	MD:			Walnut Limestone.	E
1	Ξ		stiff - very stiff; calcareous, with abu			_	59.0' to 59.5' - 7 7/8' rock bit.	" =
	=		lime nodules and lis	eston		J	59.5' to 65.5' - 4"	E
	7		clasts; gravelly (figrained). Pirst sign	ine	+		core barrel.	Ļ
	% <u>~</u>		at 30.0'.		1.01	ر ا	Bailed the hole to 58.6 and then poured in 12	È
	=		32.0' to 52.0': his			 *	bags of neat grout. The	١E
	=		plasticity; tan - re	d		<u> </u>	top of the grout in the hole is at approximatel	1
ļ			brown; stiff - very moist; calcareous.	stiff	}]	19.0'.	F
ł			morse cercerands			L	The remainder of the hole was backfilled wit	F
}	7						cuttings.	E
1						<u> </u>	All cuttings had been	E
						<u></u>	bagged directly upon re moval from the hole and	E
	\exists					m	those cuttings not used	
ļ	Ξ						to backfill the hole were storedin the area	F
						N	provided by G. D.	E
G FORM	1836	PREVIOL	IS EDITIONS ARE OBSOLETE. Palts		PROJECT		HOLE NO.	

ENG FORM 1836 PREVIOUS EDITIONS ARE OSSOLETE. Paluxy Aquifer Pollution Investigation 8AAC = 85

Hele No. 8440 - 85

								8440 - 85
DEILL	JNG LO		VISION SWD	FO	Ation rt Wort	:h		SHEET Z
ROJECT							O" Auger / 4	Carboloy
			ollution Investigation	II. BATU	B FOR EL	EVATION	SHOWN (YOU - ME	,
			ant No. 4					
RILLING				12. MANU			SHATION OF DRILL	
			USCEC	13. 7074		ng 150		UNDISTURBED
OLE NO.	(As she		ng ride!	BURE	L NO. OF EN SAMPL	ES TAKE	M 10	0
	DRILLER			14. TOT	L NUMBE	R CORE I	OXES	1
		Br	rever	IL ELEV	ATION GE	OUND WA	TER See comme	nt 1
RECTIO	OF HOL	E		IS. DATE		STA	RTED C	OMPLETED
VERTIC	AL	HCLINED	DES. FROM VERT.	<u> </u>				19 July 85
HICKNES	S OF OVE	ROURDE	N 59.0		ATION TO			
EPTH DR	ILLED IN	TO ROCK	6.5		ATURE OF		FOR SORING	92 *
OTAL DE	PTH OF	+OLE	65.5	1		A	andy hil	buch
VATION	DEPTH	LEGEND	CLASSIFICATION OF MATERIA	5	S CORE RECOV- ERY	BOX OR	(Delling time, to	MKS
- 1	40 .		(Decempion)		ERY	SAMPLE NO.		, if elemificant
								
	∃		53 01 ÷= 50 01			N	4 3545 5	M = 67 /=
{	_=		52.0' to 59.0'					M - 83 is 3.8' south
	\exists		SAND: loose; tan; wet	; cal-				and 14.8
]	⊣		careous; poorly grade			0	west of pa	
- {	-7		(fine grained); some	clay.			fence.	. 5
	コ						8A4C - 84	is located
1	⇉						468.9' noz	th of HM -
ŀ			<u>59.0'</u> to <u>64.9'</u>			ח		9' west of
ŀ	∃		LIMESTONE (Walnut For	mation)	P		g lot fence.
1	_=	-	59.0' to 60.5': mod	lerate	Ī			is located the of 8A40 -
-	\exists		ly hard; tan; highl					9' west of
ł	7		weathered, iron sta			l	fence line	
	50 —		very fossiliferous,			Q		
	コ		generally the fossi		.	٦	ļ	
-	コ	ļ	consist of (cyster) calcareous clay mat		-,	1	{	
			From 60.2' moderate		d:		†	
ł	Ⅎ		gray; weathered; ve		, ,		ł	
	_=		fossiliferous; dark			R		
)	\exists		calcareous clay mat			j .	J	
	コ					t	† •	
			(0.5%)				1.	
- 1	7		60.5' to 62.4': mo		ΤÀ	5	l '	
1	⇉		hard; gray; weather less fossiliferous,			را	ļ	
)	7		ls generally in sma			1)	
}	⇉	<u> जिल्</u>	pieces; becoming ve		59.5		†	
	60-	<u>{-</u> -; ≥ -	argillaceous.		. 0.2		1	
İ	~ <u>∃</u>	1-1212			60.5	30×	1	
ŀ		1	(0.40.) (7.51.)		AUNL LOO	l '		
- 1	→		62.4" to 63.8": so		- 0.0	1	1	
	7		gray; weathered; ve argillaceous; fewer		,		1	
l	コ	إلكبا	fossils.	•	63.5°	ł		
- 1	−;	1719	From 63.3' - modera	ately	L - Q3	1	[
1	בֹד	- 1 7-19	hard; gray; weather		65.5	1	1	
j			broken shell pieces	в.		1	1	
j	∃						1	
]		(7.01.4. (4.01.				1	
ĺ				oder-		[ĺ	
ļ	ヸ		etely hard; gray; of ered; very fossili:			1	1	
	=		(oyster) shells; a		1	1	1	
	70-		pyrite crystals; 30					
	⇉		dark gray calcareo			1	1	
1	_=		clay matrix.			1		
ļ	\exists		·					
- {	₹			i		l l	l .	
ļ	_크		64.9° to 65.5°		}	1	1	
	コ	İ	SILTSTONE : soft; h	lue	}	1	1	
[ヸ		green; calcareous; co					
	-1		small pockets of a gr	Leen			1	
ł		i	gray clay (0.05' x 0.	،۱۱).		l	1	
							1	
l	=]	}	
			T.D. 65.5'.		1	1		

METALLATION T 1 2 sheets DRILLING LOG PAULE ID. SIZE AND TYPE OF BIT * Paluxy Aquifer Pollution Investigation LOCATION (Coards 2 MANUFACTURER'S DESIGNATION OF DRILL 4(General Dynamic 12 TOTAL NOT OF OVER-USCE HOLE NO. (As ale IL TOTAL HUMBER CORE BOXES IL ELEVATION GROUND WATER Merva ECTION OF HOLE M. DATE HOLE VERTICAL DINCLINED 21 July 85 17. ELEVATION TOP OF HOLE 648.98 THICKNESS OF OVERBURDEN 59.9 18. TOTAL CORE RECOVERY FOR BORING DEPTH DRILLED INTO ROCK 19. SIGNATURE OF INSPECTOR Robert McVer B. TOTAL DEPTH OF HOLE 65.0 S CORE CLASSIFICATION OF MATERIALS REMARKS ELEVATION DEPTH LEGENO * Drilling 0.0 to 0.4 - Asphalt. 0 to 60' - 8" auger, 0.4 to 59.9 set 5' csng, 60 to 65' - 4" core. B CLAY ε Auger refusal at 60'. 0.4 to 2.4 - medium to low plasticity, medium stiff, dry, dark brown, sandy and Water first observed gravelly. during the 24 to 25' run 2.4 to 3.1. - high to medium on 22 July 85. plasticity, medium stiff, On 23 July - water at slightly moist, black. F 22'. 3.1 to 4.5 - medium to 10 high plasticity, medium stiff, very dark brown, G silty. Jars 4.5 to 6.5 - high plast, stiff, slightly moist, 0.4 to 2.4 2.4 to 3.1 В. 4.5 dark red brown, silty to c. 3.1 to slightly gravelly. D. 4.5 to 6.5 6.5 to 7.7 6.5 to 7.7 - high plast, very stiff, slightly 7.7 to 10.0 F. G. 10.0 to 15.0 moist, reddish yellow, H. 15.0 to 20.0 H caliched, silty, slightly I. 20.0 to 25.0 sandy, gravelly. J. 25.0 to 30.0 7.7 to 10.0 - low that K. 30.0 to 35.0 grades to medium plasti-L. 35.0 to 40.0 city, very stiff, slightl M. 40.0 to 45.0 moist, yellow, very sandy N. 45.0 to 50.0 silty, calcareous. 0. 50.0 to 55.0 P. 55.0 to 59.9 10.0 to 15.0 - high plast, very stiff to stiff, slightly moist, red yellow, silty, scattered sand sized lime nodules. 15.0 to 50.0 - high/medium J plasticity, medium stiff to scattered soft seams. moist, red yellow with yellow brown, silty and sandy, soft sand seam at 28.7 to 29.2', some light gray pockets(silt), some shells from 41 to 45'. K 50.0 to 59.9 - high to medium plasticity, stiff to very stiff, moist, brownish yellow and light gray, few ferriginous clasts scattered within, few sandy lime nodules. L sand/silt seams at: 58.9 to 58.9', and 59.8 to 59.9 has shaly appearance w/ s ENG FORM 18 36 PREVIOUS EDITIONS ARE OSSOLETE.

DRILLING LOG AUTET W. SIZE RED TYPE OF BIT Paluxy Aquifer Pollution Investigation LOCATION (Co. 12 MANUFACTURER'S DESIGNATION OF CRILL AF#4 (GD) 13. TOTAL NO. OF OVER-HOLE NO. (As about an drawing title 14. TOTAL HUMBER CORE BOXES L HAME OF DRILLER IS ELEVATION SHOUND WATER DIRECTION OF HOLE 16. DATE HOLE VERTICAL MINCLINED 17. ELEVATION TOP OF HOLE 7. THICKNESS OF OVERBURDEN IS. TOTAL CORE RECOVERY FOR BORING DEPTH DRILLED INTO ROCK 19. SIGNATURE OF INSPECTOR Kobert Mele TOTAL DEPTH OF HOLE SCORE BOX OR RECOVERY HO. REMARKS CLASSIFICATION OF MATERIALS 59.9 to 62.2 ARGILLACEOUS LIMESTONE weather stained until 60.7 М then an unweathered dark gray and white, jointed, massive, soft shale to hard/very hard L.S. (rock classification), moderately to well cemented, oyster shells scattered, shale N seams scattered throughout and usually grades to marl 0 Box LOST 1.3" L + 3' C 0.8

Hele No. 8A4C-86

ENG FORM 1836 PREVIOUS EDITIONS ARE OSSOLETE.

							Hele N	le 3À4C−87	_	
DRILL	LING LO	_	SOUTHWESTERN	BODG				SHEET 1 OF 2 SHEET		
I. PROJECT					WORT		8"AUGER 4		-	
GENER				10. SIZE AND TYPE OF SIT 8 "AUGER, 4"CORE						
2. LOCATION	V A OII	ates er Sid T당다다	INVESTIGATION							
1 DAILLING	AGENCY	<u> </u>	INVESTIGATION	IZ. MANG	UFACTURE		NG 1500	·F		
USCE				12 707	AL NO. OF			UNDISTURBED	<u>, </u>	
4. HÖLE HO.	(Ae about	-	8A4C-87	BURG	DEN SAMP	LES TAKE	11	0		
E. NAME OF	DRILLER		: 5A4C=57		AL NUMBE			1		
BREW				IL ELEV	VATION G	_				
6. DIRECTION				M. DATI	E HOLE		2/1/86	2/1/86		
E VERTIC	EAL	HCLINED	DEG. PROM VERT.	17 61 61	VATION TO			49.29	\dashv	
7. THICKNES	S OF OVE	REUROE	37.5					100%	⊣	
B. DEPTH OR	HLLED IN	TO ROCK	4.0		ATURE OF	INSPECT	OR	100/6	7	
9. TOTAL DE	EPTH OF	HOLE	41.5	<u> </u>			udette.			
ELEVATION	DEPTH	LEGEND	CLASSIFICATION OF MATERIA (Description)	L	RECOV	SAMPLE NO.	(Drilling time	MARKS	1	
_ • .					ERV	HO.		te., if eignificant	- 1	
	0.0								F	
	7		0.0 to 0.4		1	[A		ee water	F	
			ASPHALT, good cond	11+10				red during		
		ļ	TOTICHE, EOOG CORE	0101	Γ			g to top o	ヸ゙゙	
	▏╡	- 1	a # += a =+				primary.		F	
]			0.4 to 2.5					t primary coring.	ᅡ	
	l ∃		CLAY, medium to hi	igh				depth-dry	.E	
l i	ーコ		plasticity, stiff,	,		<u> </u>			E	
	∃		moist, brown.		1				E	
	Ⅎ	i	•			١ ـ	1		Е	
	<u> </u>	1				9	2) 1175		F	
	\exists	İ	2.5 to 6.0=			ĺ	2) <u>JARS</u>		F	
·	10.0		CLAY, low to media	ım			A) 0.0-2		F	
	70-4	ŀ	plasticity, soft,	Ì			B) 2.5-5		–	
1	7	1	moist, reddish-bro	own.		Ì	C) 5.0-6 D) 6.0-1		F	
1	ー	}		1		E	E) 10.0-		⋷	
	=	ŀ	6.0 to 37.5 [±]			_	F) 15.0-	20.0	⊨	
	=		CLAY, low plastic	ity.			G) 20.0-		E	
	ᆿ		soft, moist, sandy	7			H) 25.0-		E	
	∄		throughout, small	limy		-	I) 30.0-	35.0	E	
	二	J	nodules and blebs				J) 35.0-	.37.5	E	
ĺ	⊣		throughout, tan.	· {			•		E	
	⊐					F			E	
	=======================================		37.5 to 41.5	- 1					E	
	Ⅎ	ł	LIMESTONE, tan to	-			3) CARTO	NS	F	
:	20.65	i	brown along basal	• 1			o carto	n samples	F	
	E	!	section, fine to	1				up	F	
1	\exists	- 1	coarse grained,	.,					F	
i	크	- 1	fossiliferous, bac			6			F	
i	\exists		weathered to 39.7			Ť			F	
1	⊣	- 1	fractured, soft.				4) <u>DRIL</u>	LING	F	
	\exists						0.0 - 37	.5, 8"auge	rF	
1	∃						refusal	at top of	F	
1	\exists		T.D41.5°				limeston	е.	F	
1	∃	ļ]		н	37.5 - 4	1.5, 4"cor	·e 🏲	
	્∓			ļ		"			F	
	3			l			Remarks		. ⊨	
	7							g advanced	· F	
]:	30.4						and ream	f primary	ᆫ	
ľ	コ	- 1							E	
-	ヸ	- 1		!			B) After	coring,	E	
į	コ			!		1		ailed. 4"	+	
	#							ole groute		
ļ	ュ							PVC insert		
1	⇉						with PVC	being slo		
1	Ⅎ	ŀ		ļ	İ		withdraw	m during	F	
ļ				ŀ		J	grouting		\cdot F	
ŀ	Ⅎ	i		ļ			C) Boring	subsequen	ır 🏧	
		尹		Ì	325		backfill cuttings		F	
					. 1.	l	caretings	•		
1	ⅎ			ı		1			-	
1.	焦点			ŀ	ão	1			F	
NG FORM	40.0	艺	S EDITIONS ARE OBBOLETE.			1		HÔLE NO.	Ŀ	

Hole No. 8A4C-87 METALLATION DRILLING LOG SOUTHWESTERN PORT WORTH OF BIT 8 "AUGER 4" CORE
TI. DATUM FOR ELEVATION BROWN (138 - OF 2 SHEETS PROJECT GENERAL DYNAMICS
LOCATION (COMMISSION STATES)
PALUXY AQUIPER INVESTIGATION
DONLING AGENCY 12. MANUFACTURER'S DESIGNATION OF BRILL FAILING 1500 USCE 13. TOTAL NO. OF OVER-HOLE HO. (As a ō 8A4C-87 HAME OF DRILLER 14. TOTAL NUMBER CORE BOXES IL ELEVATION GROUND WATER ** BREWER 2/1/86 COMPLETED 16. DATE HOLE 2/1/86 SVERTICAL DINCLINED 17. ELEVATION TOP OF HOLE 7. THICKNESS OF OVERSURDEN 37.5 18. TOTAL CORE RECOVERY FOR BORING 100% DEPTH DRILLED HITO ROCK 4.0 MATURE OF IMPRETOR TOTAL DEPTH OF HOLE R.R.A 41.5 REMARKS
(Drilling time, water loss
weathering, etc., if elg CLASSIFICATION OF MATERIALS ELEVATION DEPTH LEGEN 41.5 80.0 ENG FORM 18 36 PREVIOUS EDITIONS ARE DESOLETE. PROJECT

							Hole N	la. 8 A - 88	_		
Dett	LING LO	_	SOUTHWESTERN	HISTALL	WORT	———— ч		SHEET 1			
I. PROJECT			SOUTHWESTERN				8"AIGER	OF 1 SHEETS	4		
GENERA	L DYN	AMICS		II. DAY	UN POR EL	EVATION	SHOWN (1984 AF)	4 (1)	┥		
L LOCATION	4 (Courdin	ates or St.	erica)	–							
PALUXY	AQUI	FER I	NVESTIGATION	12. MAN	UFACTUR	R'S DESI	GHATION OF DRIL	L.L.	7		
USCE	AGENCY			<u> </u>			NG 1500	: UNDISTURBED	}		
4 HOLE NO.	(As show		ing title	13. TOTA	al No. OF Den Samp	OVER- LES TAKE	DISTURBED 11	0	1		
			8A -88	├──				<u>. ; </u>	┪		
S. HAME OF	-				VATION G				-		
BREWE	R			18. 46.4				I COMPLETED	⊣		
				16. DAT	E HOLE		/1/86	2/1/86	1		
A VERTI	6 AL	METIMED	DEG. PROM VERT.		VATION TO			5/.0	┥.		
7. THICKNES	15 OF OVE	ROURDE	N 19.5				—— <u> </u>	37.0	_		
S. DEPTH DE	HLLED IN	ITO ROCK	0.0		ATURE OF		Y FOR BORING		4		
S. TOTAL DE	EPTH OF	HOLE	19.5	1.51 5.55		R. Aud			-		
	T - 1			LS			RE	MARKS	┪.		
ELEVATION		LEGEND	CLASSIFICATION OF MATERIA (Decertificate)		RECOV-	SAMPLE NO.	(Drilling time,	mater loss, depth of its., if eignificant			
<u> </u>	-	<u>-</u> -			•	<u> </u>		1	-		
1	0.0	1	0.0 to 0.3, Aspha	lt	ŀ		**		E		
ł i] =		0.3 to 3.5±		l	A	1) No f	ree water	E		
	-				["		red to top	F		
			CIAY, medium		ł			ry. Boring	F		
} .	=		plasticity, stift	•	ļ	├ ──		17.0 after	: E		
]	-7		moist, brown.		l		completi		F		
]			2 4 - 4 -+			8		•	F		
]	l ⊐		3.5 to 6.5 ²		l	0			E		
1 1	-7		CLAY, medium to h	nigh		L.			F		
] [plasticity, stiff						F		
]	∣ ⊐		moist, rust to b			С	21 7455		F		
]							2) <u>JARS</u>	•	\vdash		
	7		6.5 to 8.0 [±]			P	A) 0.0		F		
	\neg		CLAY, medium to	i an		E	B) 3.5		F		
	10.0		plasticity, stif			L	C) 6.5				
1			moist. calcareous			_	D) 8.0		F		
1			tan.	' '		F	E) 9.0		F		
1 1			odii.					5-12.5	\vdash		
1 1			8.0 to 9.0±					5-15.0	\perp		
1 1	- 7					6		0-16.0	F		
1	コ		SAND, fine to com	rse				0-18.0			
1	╛		grained, loose,		•	<u> </u>	J) 18.	0-19.5	ь		
i i		· .	clayey, gravelly		٠ .	_ <i>H</i>			F		
	\neg	ł	calcareous, brown	1.					F		
l i	コ	1	•			1			E		
l .	ᅼ		0.0.4	ļ					\vdash		
!	- 1	ļ	9.0 to 10.5	- 1		7	3) DRILL	ING	F		
i 1	7	1	SAND, fine to co	rse				19.5.8"	F		
	20.0	Γ	grained, loose,		•			refusal at	上		
, i	⇉		calcareous, tan.					'limestone			
!	1	- {	_				-41100	scraping or	, L		
	ᄀ	[10.5 to 12.5 [±]				primary	. Fragment	sÉ		
1	コ	1	SAND, coarse gra	ined.			of prim	mary materia	ã٤		
	Ⅎ	ì	loose, moist, cla				on stir	nger.	F		
		į	gravelly, brown.	· · · '				-5	尸		
	コ	Ţ	•						F		
	⊐	1	12.5 to 14.5 [±]	ļ							
		i		ايمما					F		
1 1	لسطسا	l	GRAVEL, fine gra						F		
l j	⇉	Ī	loose, moist, cla		•				F		
	크	I	brown.	-J = J •							
		1	OT OMITS						F		
	コ	ļ	14.5 to 16.0 [±]	ŀ					F		
3	٠٠٩	l		[
	Ⅎ	l	CLAY, low plastic	cıty,					F		
	7	1	soft, moist, gra	veTTA	•				F		
}	7	1	sandy, brown.	ļ					\vdash		
	コ	l	4/ 4	ļ					E		
		ļ	16.0 to 18.0						F		
j j	\exists	į	CLAY, low plastic	city.					F		
	コ]	soft, moist, san	. v.					E		
			rust to brown.	~ '					F		
1	コ					,			F		
ĺ	luutuu	i	18.0 to 19.5	_, !	, 1				F		
	ⅎ	1	GRAVEL, coarse gr								
1 1	7	1	angular, loose,		•				F		
[\	. =	ļ	calcareous, clay	ву.					F		
	40.01	1	tan to brown.			نا			上		
ENG FORM	1836	PREVIOU	S EDITIONS ARE OSSOLETE.		PROJECT			HOLE NO.			
/i											

Hole No. 8A -88 BYALLAMOR SOUTHWESTERN OF 2 SHEETS DRILLING LOG FORT WORTH

10. SAZE AND TYPE OF SATS "AUGER

11. DAYUN FOR ELEVATION SHOWN (TEMPORAL PROPERTY OF SALES AND THE PROPERTY O HOJECT GENERAL DYNAMICS LOCATION (Carting Figure) PALUXY AQUIFER INVESTIGATION 12. MANUFACTURER'S DESIGNATION OF DRILL PAILING 1500 USCE HO. (As alsown an drawing rittle and Mic remine) BURDEN SAMPLES TAKEN ō 11 88-A8 14. TOTAL NUMBER CORE BOXES IS ELEVATION GROUND WATER BREWER 2/1/86 2/1/86 MERTICAL MINCLINED 17. ELEVATION TOP OF HOLE 7. THICKNESS OF OVERSURDEN 19.5 IS. TOTAL CORE RECOVERY FOR SORING 19. SIGNATURE OF INSPECTOR DEPTH DRILLED INTO ROCK 0.0 TOTAL DEPTH OF HOLE <u> 19.5</u> REMARKS
(Drilling time, water loos, wanthering, etc., if aigns COME BOX OR RECOVERAMPLE ERY HO. CLAMIFICATION OF MATERIALS LEGEND ELEVATION DEPTH 40.0 19.5 LIMESTONE, (auger refusal on limestone) T.D.-19.5 70.0 <u>80.</u>0-ENG FORM 18 36 PREVIOUS EDITIONS ARE OBSOLETE.

Hele No. 8A -89 DEILLING LOG SOUTHWESTERN FORT WORTH ---10. SIZE AND TYPE OF BIT GENERAL DYNAMICS PALUXY AQUIFER INVESTIGATION 12 MANUFACTURER'S DESIGNATION OF ORILL S. DRILLING AGENCY PAILING 1500 USCE 13. TOTAL HO. OF OVER-L. HOLE HO. (As also on an absorbed title 11 8A-89 14. TOTAL NUMBER CORE BOXES BREWER IS ELEVATION GROUND WATER 2/2/86 TVERTICAL MINCLINED 17. ELEVATION TOP OF HOLE -- 649.35 46.0 7. THICKHESS OF OVERBURDEN 18. TOTAL CORE RECOVERY FOR BORING --B. DEPTH DRILLED INTO ROCK 19. SIGNATURE OF INSPECTOR TOTAL DEPTH OF HOLE 46.0 S CORE BOX OR RECOV- SAMPLE ERY NO. REMARKS CLASSIFICATION OF MATERIALS ELEVATION DEPTH LEGEND (Drilling time, water love, depth of weathering, etc., if eignificant) 0.0 0.0 to 0.2, Asphalt 1) Free water <u>to 3.0</u>± encountered @34.0' Α below grade. 24 hours CLAY, medium to high later free.water. plasticity, stiff, level stabilized moist, brown. В @ 31.0ft. below grade. 3.0 to 5.0 ± CLAY, high plasticity, stiff to hard, moist, c reddish-brown. 5.0 to 14.0± CLAY, low to medium plasticity, soft, 2) JARS moist, sandy, A) 0.0-3.0 D calcareous, tan. 3.0-5.0 B) 5.0-10.0 C) 14.0 to 24.5 (ם 10.0-14.0 GRAVEL, fine to coarse grained, rounded to E) 14.0-15.0 E F) 15.0-20.0 20.0-24.5 subrounded, loose, G) moist, very clayey, tan to brown. H) 24.5-30.0 I) 30.0-32.0 J) 32.0-34.5 F 34.5-40.0 40.0-46.0 K) 24.5 to 32.0 ± CLAY, low plasticity, soft, moist, gravelly tan. G 32.0 to 34.5+ 3) DRILLING 0.0 - 46.0, 8" Auger refusal at SAND, fine to coarse grained, loose, dry, clayey, gravelly, tan top of limestone. - Auger scraping on top of primar, to brown. Fragments of prinary H 34.5 to 46.0 on stinger. GRAVEL, fine to coars Remarks: ground water grained, angular to sample obtained for subangular, dense, laboratory analysis. wet, clayey, sandy, tan to brown. 46.Q J LIMESTONE (auger refusal on limestone) ĸ ENG FORM 18 36 PREVIOUS EDITIONS ARE OSSOLETE. PROJECT

SHEET 2 SHEETS METALLATION DRILLING LOG SOUTHWESTERN FORT WORTH ROJECT 16. SIZE AND TYPE OF BIT 8 "AUGER DYNAMICS PALUXY AQUIPER INVESTIGATION
ORTHUM AGENCY
USCE PAILING 1500 HOLE NO. (As about on de UNDISTURBED BURDEN SAMPLES TAKEN 0 8A-89 14. TOTAL NUMBER CORE BOXES IL ELEVATION GROUND WATER ** 2/2/86 2/2/86 TVERTICAL | INCLINED 17. ELEVATION TOP OF HOLE THICKNESS OF OVERBURDEN 46.0 IS. TOTAL CORE RECOVERY FOR SORING DEPTH DRILLED INTO ROCK 0.0 TOTAL DEPTH OF HOLE 46.0 REMARKS
(Drilling time, motor loce, measuring, etc., if eign BOX OR SAMPLE NO. RECOV-CLASSIFICATION OF MATERIALS (Poseription) ELEVATION DEPTH LEGEND 40.0 L T.D.-46.0' 8 8 mlmhindinnlinninninninninninninninninni 80.0 PROJECT ENG FORM 18 36 PREVIOUS EDITIONS ARE OSSOLETE.

Hole No. 8A -90

							Hole No.		
DOLL	ING LO		VISION	INSTALL				SHEET	•
PROJECT			SOUTHWESTERN		WORT		8 "AUGER	OF 1	SHEETS
GENERA	L DYN			TI. BAT	JE POR EI	EVATION	SHOWN (THE & MEL	,	
LOCATION									
DRILLING		FER I	NVESTIGATION	IZ MANG			G 1500		-
USCE				13. 707/				UNDIST	TUR SED
HOLE NO.	(As also		Ma Hide	DUR	AL NO. OF	LÉS TAKE	12		
HAME OF	DRILLER		8A -90	14. TOT	AL NUMBE	A CORE	OXES		
BREWE	_			IS ELEV	VATION G	HOUND WA	TER		
DIRECTIO	H OF HOL			IS. DATE	E HOLE		/- /a/	DAP LET	
A VERTIC	EAL	HCLINED	DES. PROM VERT.					2/4/8	
THICKNES	S OF OVE	ROURDER	39.0		VATION TO			18.7	74
DEPTH DR	ILLED IN	TO ROCK			ATURE OF		Y FOR BORING		
TOTAL DE	PTH OF	+OLE	39.0	1		R.R.A.	Zette		
								RKS	
HOITAVE.	DEPTH		CLASSIFICATION OF MATERIA (Description)		RECOV-	BOX OR SAMPLE NO.	(Drilling time, und	er loon, d if elemiti	ingsh of inans
	0.0		0.0 1.0 2 4.000	1+	 -	- ' -			
	~.'` `	ł	0.0 to 0.3. Aspha	.16	l		1) During		
ŀ	コ	ļ	0. to 3.5^{-1}		ĺ	Α	free water	enc	ounte:
Ì	⇉	j	CLAY, medium to h	igh	l	"	@ 24.0ft.		
1	⇉	i	plasticity, stiff	,			grade. 24		
ļ		ŀ	moist, brown to b	lack	ĺ	0	static was		
l	3	- }	2 4 - 5 2 +		Í	B	taped at 2	-	
1	3		3.5 to 7.0±				below gra	de.	
ł	ㅋ	}	CLAY, medium to h	igh		С			
ļ	7	Į.	plasticity, stiff	.])	 -			
1	コ	Í	moist, brown to ru	ust.		((
1	ᆿ	1	7.0 to 18.5±	ſ		ם			
ļ	コ			- 1			2) JARS		
- [10.0	1	CLAY, low to media	um ļ				2 6	
- 1	<u>-</u> -	ļ	plasticity, soft,	ļ		1 1	A) 0.0-1		
	\exists	İ	moist, sandy, tan	. 1			B) 3.5- C) 5.0-	7.0	
1	ㅋ	ł	18.5 to 21.0 [±]	j		ε	D) 7.0-		
- 1	コ	1				-	E) 10.0)
Į.	7	į	CLAY, high plastic	city		(F) 15.0	-18.5	,
ĺ	7	ł	stiff, moist, gra		•	1	G) 18.5		
1	⇉	J	calcareous, brown	•		 	H) 21.0		
}	ュ	1	21.0 to 39.0	1]	1) 25.0		
j	コ	ļ				F	J) 27.0		
1	Ⅎ		GRAVEL	[, ,		K) 30.0 L) 35.0		
}]	21.0 - 27.0	- 1			٠, رر ر	<i></i>	•
1	\exists	- 1	fine to coarse						
}	20.3	}	grained, round	ed		6			
- 1	20+9	ì	to subrounded,	ļ			- • -		
i	コ	ļ	loose, moist to	o wet			3) <u>DRILLI</u>	NG	
j	コ)	clayey, brown.	Ì		i 1	0.0 - 3	9.0,	8"
ĺ	コ	- 1	27 0 ~ 30 0	1		н	auger re	fusal	at
- 1	Ⅎ	- (27.0 ¥ 39.0			"	top of 1		
J		1	fine to coarse				-Auger s		
1	3	[grained, angula	ar			primary.	Frag	ments
1	_7	- 1	to subangular.	ì	Ì	,	of limest	one; c	n
	\exists	- 1	cobbles throug			'	stinger.		
- 1	ヸ	- (dense, wet, ta		ļ		Remarks: g		
- 1	コ	- 1		İ		_	sample obt		
ſ	コ		39.0	J		5	laboratory	ana.	rysis
1		-	LIMESTONE, (auger	1	1				
J	30 +9		refusal on limest	one)		 			
- 1	Ⅎ	- 1		- 1					
1	_=	1		- 1	1				
1	\exists	ŀ	T.D39.0'	ŀ		K			
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								Hel	e Ne.	8 A-91	
Dett	LING LO	YG	DIVISION		INSTALL					SHEET 1	\Box
I. PROJECT		- 1	SOUTH	WESTERN		WORT		SMATICED	_	OF 1 SHEE	
GENER	AL DY				10. SIZE AND TYPE OF BIT 8 "AUGER 11. DAYUM FOR ELEVATION SHOWN (TEM _ MEL)						
E LOCATION				MTG4 MTON				IGNATION OF			
3. DRILLING	AGENCY	r r.R	THARES	TICATION	'& WANL	r ag i URE		LING 1500)		
USCE	/A		-taa Hela	· · · · · · · · · · · · · · · · · · ·	12. TOT/	L NO. OF			0	UNDISTURBE	•
- M- M-				8 A-91		AL HUMPE		`		<u> </u>	\dashv
& NAME OF		1				ATION GE			*		\dashv
BREWE	R W OF HO	LE			+		187	ARTED		DMPLETED	┥.
Æ YERTI				0E6. FROM VERT.				/4/86		1/4/86	-
7. THICKNES	S OF OV	ERBURO	EH	31.5		VATION TO				47.21	
e. DEPTH OF				0.0		AL CORE P		TOR	3	<u> </u>	-1
S. TOTAL DI	EPTH OF	HOLE		31.5	1	R	R.A.	detta			_
ELEVATION	DEPTH	LEGEN	9	LASSIFICATION OF MATERI (Description)	ALS	S CORE RECOV- ERY	BOX OF	E (Drilling to	REMA	RKS or lose, depth of , if eigniticand	,
•			<u> </u>	4		ERY	MG.		* ***	, If eigniticent	\bot
	0.0	1	Το.	0 to 0.3			1	1) No	free	e water	E
) =	}	-	PHALT, good con	ditio					ed to to	, †
	_	}	1 23	FIREIT, ECOC CO.		Ţ				y. Borina	
	=	1	1 ^	3 to 3.0 [±]				taped	to	iepth-dry	/• إ
ļ	_=	1			1b	}					F
I	=	‡	ဌ	AY, medium to hasticity, stiff	ızgn		visu	ı a 1			F
1	=	1	m o	ist, brown to b	lack.		ider	-			F
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Ì] =	1	1 3.	0 to 9.5±		}]			F
1	_	1		AY, low to medi		1		1			E
	=	1	;	asticity, soft,	um			2) <u>JA</u>			Е
i	10.0	1		ist, brown.	'		i	visu	al	identifi	ca t [_c
l	10.0	3	1				1 1				E
!] =	3	9.	5 to 26.5		<u> </u>					E
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i '	=	1	be	4.0-15.5, 18.0- coming increasi	ngly	1	1 1			1.5, 8"	F
1		1	CS	lcareous below	24.0	ľ	1	Auge	י די	efusal a	ŧF
i	=	1		th calcium cart		!		top	of	primary.	- ⊢
	-	7		ebs and seams i ection. tan.	ın			-Aue	ger s	craping	on
	=	3	"	coton, can		}	1 1			l imaş tone ts of pr	
	20.0	3	26	5.5 to 31.5					•	ger.	-**E
	20.0	1	_			•		"	, ,	6	· E
	-	1		AY, high plastitiff, moist, cal	LCITY,	10	{	ł			E
		1		th numerous cal		ſ		1			⊢
	=	‡	CE	rbonate seams a	ind	ļ					F
}	_	1		lebs in section,	, tan	[1			上
	=	1	to	gray to rust.		,					F
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	=	3		IMESTONE, (auger		1					F
1		3	r	efusal on limes	tone)	<u> </u>		1			E
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ENG FORM	1836	PREV	IOUS EDI	TIONS ARE DESOLETE.		PROJEC	T			HOLE NO	.
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					_		Hole No. 8	A-92			
DELL	LING LO	6	OUTHWEST ERN	BOR		v		SHEET 1			
I. PROJECT				10. SIZE	MORT	OF BIT	8 "AUGER	OF T SHE	***		
GENERA:	L DYN	AMICS	5	II. DAT	UN FOR KI	EVATION	SHOWN (THE - MILL)		_		
PALUXY	AQUI	FER 1	NVESTIGATION	12. MANUFACTURER'S DESIGNATION OF DRILL							
1 DRILLING	AGENCY			L	F	AILIN	G 1500				
USCE	(As show	-	ing title!	13. TOT	AL NO. OF	OVER- LES TAKE	. ;	O	40		
			8A -92		AL NUMBE		<u> </u>	<u> </u>	\dashv		
BREWE					VATION G				\dashv		
& DIRECTION		£				1 ST A	RTED CO	#LETED	\dashv		
* VERTIC	CAL []	NCLINE	0 0E6. PROM VERT.		E HOLE			/4/86			
7. THICKNES	S OF OVE	REUROE	tw 22.5	17. ELE	VATION TO	P OF HO	LE 647.0	<u> </u>			
a. DEPTH DR					AL CORE !		Y FOR BORING		-4		
S. TOTAL DE	EPTH OF H	10LE	23.5	19. 34GN	ATURE OF	R	Audette				
ELEVATION	DEPTH			us	1 CORE	BOX OR SAMPLE NO.	DEMAR	C\$			
	52711		(Deceription)		ERY	NO.	(Drilling time, water weathering, etc., i	i elgnilicensi	"		
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i			0.0 to 0.3			.	1) No free		E		
1			ASPHALT, good cond	iitio	h	!	encountered				
	∣ ≓		,		1		of primary taped to de				
	=		0.3 to 2.5 [±]		}			- p	ĭE		
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	╛		CLAY, medium to his plasticity, stiff	-Ru	} ·	visu			Ë		
	╛		moist, brown to b	Lack.		iden	t.		E		
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	⇉		2.5 to 5.5±				2) JARS		F		
							visual ide	entific	a t loo		
	⊣		CLAY, low plastic soft, moist, very	Lty,			113001 10	,	~ ĭĔ		
	10.0		gravelly throughou	ıt.				·	E		
1	\exists		calcareous, tan.	-					E		
i i						!			ᆮ		
l	コ		5.5 to 16.5 [±]						⊨		
1	=		CLAY, low to media	100			3) <u>DRILLIN</u>	<u> </u>	F		
j	ーゴ		plasticity, soft,				0.0 - 22.	5, 8"	E		
	╡		moist, sandy,		:		Auger ref				
1 }	• 🗆		calcareous, tan.]]]	top of lin	nestone	· _		
,	ョ					1	primary. l -A_ger ad	m noed	⊨		
	7		16.5 to 22.5			visua ident			of		
	7		CLAY, medium plas	ticit			fragments	of pri	mary		
[⊣	j	stiff, moist,			1	on stinger	r.	⊨		
	J	į	gravelly, calcare				Note: Bori	ng offs	set⊨		
	20.허		with calcium carbo nodules and blebs	nate			approximat	ely 10'	' .F		
1	\exists		in section, brown	to			east of ta		a tre		
	\dashv		tan.		:		due to tra		F		
	7						COMMITTURE	•	Þ		
	_==		22.5 to 23.5						F		
	\exists	ł		grav					⊨		
	3		LIMESTONE, light fine grained, sof	ŧ. 1					F		
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	=		T.D23.5'						F		
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NG FORM	10101										

Hole No. SA-93 TARLES OF DOILLING LOG FORT WORTH SOUTHWESTERN OF1 SHEETS M. MIZE AND TYPE OF MITS "AUGER GENERAL DYNAMICS PALUXY AQUIPER INVESTIGATION IZ MANUFACTURER'S DEMONATION OF BOILS FAILING 1500 USCE HOLE NO. (As shown as desiring tell 12 TOTAL NO. OF OVER-0 8A-93 14. TOTAL HUMBER CORE BOXES IS ELEVATION SHOUND WATER BREWER TOVERTICAL DINCLINED 2/5/86 2/5/86 17. LEVATION TOP OF HOLE -- 650.96 7. THICKNESS OF OVERSUSDEN 39.0 M. TOTAL CORE RECOVERY FOR BORING L DEPTH DRILLED HITO ROCK 0.0 TOTAL DEPTH OF HOLE 39.0 NECOVE SAMPLE CLASSIFICATION OF MATERIALS REMARKS ELEVATION DEPTH LEGEM 0.0 1) Free water level 0.0 to 0.3 taped at 29.2ft. Asphalt, good condition below grade. Static water level 0.3 to 1.5 ± taped at 27.0ft. risua CLAY, medium to high ident below grade. plasticity, stiff, moist, brown to black. 1.5 to 6.0[±] CLAY, high plasticity, stiff, moist, reddish-brown. 2) JARS visual identification 6.0 to 11.0± CLAY, low plasticity, soft, moist, very sandy throughout, calcareous, tan. ident. 3) DRILLING 0.0 - 39.0, 8" 11.0 to 29.2[±] Auger refusal at CLAY, medium to high top of limestone plasticity, stiff, primary. Auger moist, alightly scraping on top of gravelly, calcareous with calcium carbonate 20.0 primary with fragments of primary on stinger blebs and nodules in section, brown to tan NoteA)Boring offset approximately 20' to rust. sort: of taped location due to 29.2 to 39.0 traffic conditions. GRAVEL, fine to coarse grained, angulat to B) ground water sample subrounded, loose, obtained for laboratery wet, clayey, sandy, tan to brown. analysis. 39.0 visuall LIMESTONE, (auger lidenti. refusal on limestone) T.D.-39.0' 40.0 ING PORM 1836 PREVIOUS EDITIONS ARE OSSOLETE.

		16	VISION	HISTAL	ATION		ISM	EET 1			
	LING LO		OUTHWESTERN		WORT	н		1 SHEETS			
1. PROJECT				19. SIZE	AND TYP	E OF MIT	"AUGER				
GENERA	T DAN	MICS		II. BAY	DE FOR E	LEVATIO	SHOWN (750 - MIL)				
L LOCATION	Courte	T P P P	INVESTIGATION	<u> </u>							
3. DRILLING	AGENCY	TEEK	IN EDITORITON	12. MANUFACTURER'S DESIGNATION OF BRILL PAILING 1500							
USCE				12 70-				DISTURSED			
4. HOLE NO.	(As show	-	ng title	- 606	AL NO. OF	LES TAKE	0	0			
L HAME OF	Date 1 de		8 A - 94	14 TOT	AL HUMBE	R CORE	oxts				
BREWER					VATION 6						
6. DIRECTIO	H OF HOL			<u> </u>			ATED COMPL				
24 VERTI			DES. FROM VERT.	TE DAT	E HOLE		/6/86 2/6/	86			
				17. ELE	VATION TO	OF OF HO	u 645	7.72			
7. THICKNES				10. TOT	AL CORE	RECOVER	Y FOR BORING	•			
S. DEPTH DE				19. SIGN	ATURE OF	INSPECT	· 09 14				
9. TOTAL DE	EPTH OF	HOLE	20.0	L		K.K.A.	dette				
ELEVATION	DEPTH	LEGEND	CLASSIFICATION OF MATERIA (Department)	4.5	RECOV	SAMPLE NO.	REMARKS (Drilling time, water les weathering, etc., if al	-			
	•	!			ERT	HQ.	meathering, etc., if al	gnificant			
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	=		0.0 to 0.5		1		1) No free w	ater E			
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1	∣ ⊐		h		1	visua		E			
			4.5 to 19.0 [±]		1	ldent	•	F			
1 1	7		CLAY, low plastici	ty,	1	١.		F			
ł i	10.4		soft, moist, sandy			1 1	2) JARS	=			
j j	10-11		throughout especia	lly	,			e1 00 + 1 0 E			
	l ∃		along basal section	n,			visual identi	1102 010			
1	▏ 긕	1	calcareous with sm	all				F			
1	ーコ	1	limy nodules in se	etion	•			⊢			
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]		l	19.0 to 20.0			[[31 550000000	F			
j i	ı ∵⊐] [3) DRILLING	E			
{	コ	[CLAY-SHALE, tan to				0.0 - 20.0,				
Į 1	コ	ĺ	greenish-gray, calcareous, soft.				refusal at t	op of E			
1	Ⅎ	ľ	AMERICAN SOLLS				limestone pr	imary.			
1	\dashv	- 1					Auger scrapi				
	7		20.0				limestone wi				
	20.4		LIMESTONE, (auger			1	fragments of	Timestone			
]	يسون		refusal on limesto	ne)		┍┸┈	on stinger.	F			
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ENG FORM	1836	PREVIOU	S EDITIONS ARE OBSOLETE.	l	PROJECT			HOLE NO.			
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e. DIRECTIO	M OF HOL					N. DAT	E HOLE	_	27	6/86	276	786	1
(A) VERTI	en 🗆	MELIM	<o< th=""><th> 066. PI</th><th>WW VERT.</th><th>17. ELE</th><th>VATION TO</th><th>DP 0</th><th></th><th></th><th></th><th>2.95</th><th>1</th></o<>	066. PI	WW VERT.	17. ELE	VATION TO	DP 0				2.95	1
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B. DEPTH DE			CK	44.0		19. SIGN	ATURE OF		PECT R. K				7
ELEVATION		_		LASSIFICATION O	F MATERIA	<u>. </u>	MECOV-	_			MARKS		1
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			22	.0 to 41.	<u>0</u> 2			[1				E
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DIG PORM	1836	PREVI	OUS 2017		TR.		PROJECT					HOLE NO.	

							Hele K	8A-95			
DRIL	LING LO	E C	SOUTHWESTERN	POPT	WORT!	ŧ		SHEET 2 OF 2 SHEETS			
1. PROJECT				19. SIZE	AND TYP	E OF BIT	8"AUGER				
GENER	AL DY	NAMI	CS INVESTIGATION	11. BAT	UM FOR E	LEVATION	SHOWN (788 a M	2.0			
PALUX	Y AQU	IFER	INVESTIGATION	12. MANUPACTURER'S DESIGNATION OF BAILL							
USCE	MENCY			FAILING 1500 12. TOTAL NO. OF OVER- BURDEN SAMPLES TAKEN OSTURBED UNDISTURBED							
USCE	(As one	-	8A-95	BUA	DEN SAME	LES TAKE	0	0			
S. NAME OF	DRILLER		OX-93		AL HUMBE						
BREW	ER			IS ELE	VATION G			COMPLETED			
25 VERT			D DEG. PROM VERY.	H. DAT	E HOLE		6/86	2/6/86			
7. THICKNES	S OF OVE	20000	EM 44.0	17. ELE	VATION TO	OP OF HO	LE				
B. DEPTH D			<u> </u>		AL CORE						
8. TOTAL DI	EPTH OF	HOLE	44.0			R.R.	lidette				
ELEVATION	ОЕРТН	LEGEN	CLASSIFICATION OF MATERIA	4	NECOV-	BOX OR SAMPLE NG.	(Draffing time, w	SARKS meer lace, depth of la., if eignificants			
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	Ξ	}	CLAY, low plastic	ity.	1	ł I		F
	=		soft, moist, grav	elly,		visus	1	E
	=		limy with nodules section, tan to b			ideni	•	E
	=		30001011, 0011 00			l 1		=
]			4.5 to 24.5±		•		2) JARS	F
	#		CLAY, low to medi	1178 ·				ntification
[10-9		plasticity, soft,				Visual ide	ntilleation -
	Ξ		moist, sandy thro	ughou	t,			F
			scattered in sect					F
1	i ⊐		tan.) }		E
					ĺ		3) <u>DRILLI</u>	NG E
·	-∃		24.5 to 34.0	ļ			0.0 - 35.0	, 8"Auger
	3		CLAY, medium to h				to depth.	muzer - E
	╡		plasticity, stiff moist, sandy,	'				nto limestar
	∃		calcareous, reddi	sh-			of limesto	ith fragment ne on
	\exists		brown.				stinger.	··· F
	. =							E
	20-9		34.0 to 35.0			visua		E
	=		LIMESTONE, light			ident	•	=
ļ	-3	ļ	fine to coarse grants	164	•	1	1	F
	⇒							E
	ᆿ		T.D35.0'					E
	\exists	i						E
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ENG FORM	<u>4070</u>				PROJECT			HOLE NO.
	1536	PREVIOU	S EDITIONS ARE DESCLETE.	l				(

(TRANSLUCENT)

Hole No. da -98 A CHEMICS DEILLING LOG PORT WORTH

9. SIZE AND TYPE OF MY 8 "AUGER

11. DATUS FOR ELEVATION SHOWN (1988 - ME) SOUTHWESTERN 7.91.74 GENERAL DYNAMICS PALUXY AQUIFER INVESTIGATION 12. MANUFACTURER'S DESIGNATION OF DRILL PAILING 1500 12. TOTAL NO. OF OVER-UNDISTURBED 8A-98 BREWER 2/7/86 2/7/86 XVERTICAL | INCLINED 17. ELEVATION TOP OF HOLE -- 643,64 7. THICKNESS OF OVERSURDEN 19. TOTAL CORE RECOVERY FOR BORING B. DEPTH ORILLED INTO ROCK 18. SIGNATURE OF INSPECTOR B. TOTAL DEPTH OF HOLE 4.5 REMARKS S CORE CLASSIFICATION OF MATERIALS ELEVATION DEPTH LEGENC 0.0 1) boring taped to visual depth-dry. 0.0 to 0.3 ASPHALT, good condition ident. 0.3 to 1.5 CLAY, low plasticity, soft, moist, gravelly, sandy, brown. 1.5 to 3.5 2) JARS LIMESTONE, light gray, fine to coarse grained arenaceous, soft. visual identificati 3.5 to 4.5 CLAY-SHALE, tan to greenish-gray, calcareous, soft. 3) DRILLING 0.0 - 4.5, 8"Auger to depth. T.D.-4.5° Remarks: Boring offset approximately 35 ft. west on line ENG FORM 18 36 PREVIOUS EDITIONS ARE OSSOLETE.

							Hole No.	8 A- 99
DRIL	LING LO	6 °	SOUTHWESTERN	RODE	WORT	. —		OF 1 SHEETS
I. PROJECT							8 "AUGER	
GENERA	L DYN	AMICS	<u> </u>	11. BAY	UE FOR E	LEVATION	SHOWN (THE - NEED	3
PALUX	Y AQU	IPER	INVESTIGATION	12 MAN	UFACTUR	TO SERVE	MATION OF DRILL	
IT DAMPLING	ASENCY					AILING	1500	
USCE	(As show		be title	13. TOT	AL NO. OF	OVER-	DISTURBED	UNDISTURBED
			8 A - 99			R CORE S	<u> </u>	. 0
BREWER						ROUND WA		 -
S. DIRECTIO					E HOLE	BTA		OWFLETED
Z VERTI	CAL	MCLIMED	DES. FROM VERT.				7/86 2	/7/86
7. THICKNES	S OF OVE	REVROE	n 2,5			OP OF HO		4.98
B. DEPTH OF	HLLED IN	TO ROCK			ATIME OF		^~	
S. TOTAL DE	EPTH OF 1	HOLE	4.0			R.A.	dette	
ELEVATION	DEPTH	LEGENO	CLASSIFICATION OF MATERIA	3		SOX OR SAMPLE NO.	REMA	
			(Description		ERY	HO.	medianing of	er lose, depth of . If elgrificant
	0.0					1		
1	7		0.0 to 0.4			visus	11) Boring	taped to
1	-				L	iden	depth-dr	λ. ‡
1	7		ASPHALT, good con	u1610	ľ'			;
	=	口	0 1: 4- 0 "		ł	الل		;
1	l I		0.4 to 2.5]			†
	1 3		CLAY, low plastic	ity.	1			
	I∃		soft, moist, grav sandy, brown.	атту.	1			ļ
]	⊢∃	- 1	Smith? OF OAll!			i I		1
	<u>-</u>	l	2.5 to 4.0		1]	2) <u>JARS</u>	ļ
	=	1			ŀ		visual ide	ntificatio
	\exists	i	LIMESTONE, light fine to coarse gr	gray.		ŀi		
	10.0		soft.	riveo	•			E
1 1	╛	ŀ	33233]		- E
	ーゴ							
]]			T.D4.0°			1	2) DD####	,, E
1 1		ł					3) <u>DRILLI</u>	
	ーコ	- 1				i I		8"Auger
1	⇉	ĺ				1	primary.	n. limesto
i i	ーコ	- [1	br twee 3 .	Ł
l	7	[•				Remarks: H	Boring
i	⊣	- 1						proximately
1 1	\equiv	1					five feet	southwest
i i	3	1						ļ.
1	20.0			1				ļ
	=							ļ
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	40.0					Ì		‡
ING FORM	1836 P	REVIOUS	EDITIONS ARE OFFICE .	\neg	PROJECT			HOLE NO.

TRANSLUCENTS

Hele No._8A4C-100 1.71UUA.75 ----DOLLING LOS SOUTHWESTERN FORT WORTH OF 1 SHEETS 11. BAYLE FOR ELEVATION BROWN (THE ... CORE GENERAL DYNAMICS PALUXY AQUIFER INVESTIGATION 12. MARKET ACTUMENTS OF BANKET AT BANKET PAILING 1500 USCE HOLE NO. (As above on a ٥ 8A4C-100 IA TOTAL HUMBER CORE BOXES HAME OF BRILLER IS ELEVATION COOKING TATES 44 BREWER 2/8/86 2/9/86 DEVERTICAL TIMELIMED 17. ELEVATION TOP OF HOLE -- 647. 10 7. THICKNESS OF OVERSUROEN 480 M. TOTAL CORE RECOVERY FOR BORING DEPTH DRILLED HITO ROCK R.R. Augette 4.0 52.0 S CORE SAMPLE CLASSIFICATION OF MATERIALS DEMARKS (Drilling time, omice face, depth of 0.0 1) During augering 0.0 to 0.4 free water taped @ 33.0ft. below ASPHALT, good condition grade. 2hours later 0.4 to 4.0± static water level CLAY, low plasticity, soft, moist, gravelly, limy with nodules taped # 32.0ft. below grade. visual in section, tan to ident. brown. 4.0 to 33.5 10.0 2) JARS CLAY. low to medium plasticity, soft to visual identificatio stiff in zones, sandy throughout, small limy nodules scattered in section, tan. 33.5 to 48.0 3) DRILLING GRAVEL, fine to coarse 0.0 - 48.0, 8 auger refusal at top of grained, angular to subrounded, loose, wet, clean, tan. limestone primary. 48.0 - 52.0, 4"core to depth. 0.0 48.0 to 52.0 LIMESTONE, gray, fine to coarse A) ground mater sample grained, argillaceous obtained for laboratory with shale stringers analysis. and thin seams in B) Casing advanced top of primary and visual reamed. section, weathered, soft. ident C) After coring boring bailed. 4". T.D.-52.0' PVC pipe inserted to depth.Hole grouted through PVC insert 30 40 with PVC being slowly withdrawn during grouting. D) Boring subsequen Ly backfilled with cuttings. E) Boring offset approximately 7.0ft southwest. 40.Œ

DRILLING LOG PORT WORTH

D. SIZE AND TYPE OF BITS "A UGER, 4"CORE
TI. DATUS FOR ELEVATION SHOWN (1985 & MEC) SOUTHWESTERN OF 2 SHEETS BOJECT 12. MANUPACTURER'S DESIGNATION OF ORICL.
PAILING 1500
13. TOTAL MG. OF OVER- | DESTURBED 12. TOTAL NO. OF OVER-0 8A4C-100 BER CORE BOXES IL ELEVATION GROUND WATER 2/9/86 2/8/86 TO VERTICAL | INCL 17. ELEVATION TOP OF HOLE 48.0 4.0 . THICKNESS OF OVERSURDEN IS. TOTAL CORE RECOVERY FOR BORING DEPTH DRILLED INTO ROCK R. A. 52.0 TOTAL DEPTH OF HOLE BOX OR SAMPLE S CORE CLASSIFICATION OF MATERIALS DEPTH LEGEND 48-0 40 1 520 80.0 ENG FORM 1836 PREVIOUS EDITIONS ARE OSSOLETE.

(TRANSLUCENT)

Hole No. 3A4C-101 THE WAR SHEET DRILLING LOG SOUTHWESTERN FORT WORTH OF 2 SHEETS PARET 11. DAYON FOR ELEVATION SHOWS COM GENERAL DYNAMICS PALUXY AQUIPER INVESTIGATION LOCATION /C 12. MANUFACTURER'S DESIGNATION OF DRILL PAILING 1500 USCE HOLE NO. (As about an drawing title and the manhor) 11. TOTAL NO. OF OVER- DISTURGED BURDEN SAMPLES TAKEN UNDISTURBED 8A4C-101 14. TOTAL HUMBER CORE BOXES MAME OF DRILLER 18. ELEVATION GROUND WATER BREWER 2/11/86 IL DATE HOLE TYERTICAL | INCLINED ---2/11/86 --648.35 17. ELEVATION TOP OF HOLE 47.5 4.0 7. THICKNESS OF OVERBURDEN 18. TOTAL CORE RECOVERY FOR SORING 77.0% B. DEPTH DRILLED INTO BOCK 19. SIGNATURE OF INSPECTOR B. TOTAL DEPTH OF HOLE 51.5 S CORE BOX OR SAMPLE NO. REMARKS
(Drilling time, meter loce, meeting, etc., if sign CLASSIFICATION OF MATERIALS (Posseription) ELEVATION DEPTH LEGEND 4 0.0 to 0.5 1) During augering free water encountered ASPHALT, good condition at 34.0ft. below 0.2 to 1.2 to grade. SAND, fine to coarse -Static water level taped at 30.5ft bel w gr ined, loose, dry, gravelly, clayey, grade. brown. visual 1.2 to 4.0[±] ident. CLAY, medium to high plasticity, stiff, moist, brown to black. 2) JARS visual identification 4.0 to 21.0 ± CLAY, low to medium plasticity, soft, to stiff in zones, moist, becoming increasingly sandy below 12.0° to depth. calcareous with limy nodules and blebs 3) DRILLING noted along basal 0.0 = 47.5, 8"auger refusal at top of section, tan. 21.0 to 23.0± limestone primary. GRAVEL, fine to coarse 47.5 - 51.5. 4"core grained, subrounded to rounded, loose, dry, clayey, sandy, tan. to depth. Remarks: isua ident.A) casing advanced 23.0 to 35.0± top of primary and reamed. CLAY, low plasticity, soft, moist, calcareous, B) After coring, hote bailed repeatedly until nearly dry. One 94 lb. bag of cemen tan. 35.0 to 44.5± used to grout hole. CLAY, medium to high plasticity, stiff, wet calcareous with limy Grout extended to 40.0ft. datum below 30.0 grade. seams and nodules throughout, sandy, C) Boring subsequently backfilled with cuttings. reddish-brown. D) ground water sample 44.5 to 47.5 obtained for labora ery GRAVEL, coarse grained, rounded to subrounded, analysis. loose, wet, clayey, brown. 40.7 HOLE NO.

Hole No.8A4C-101 STALLATION DRILLING LOG FORT WORTH

11. DATUS FOR ELEVATION SHOWS (1987 & MEC) SOUTHWESTERN OF 2 SHEETS . PROJECT GENERAL DYNAMICS PALUXY AQUIPER INVESTIGATION 12. MANUFACTURER'S DESIGNATION OF DRILL PAILING 1500 USCE HOLE NO. (As about an dearing state and the manded 13. TOTAL NO. OF OVER-MURDEN SAMPLES TAKEN 0_ 8A4C-101 14. TOTAL NUMBER CORE BOXES NAME OF ORILLER BREWER IS ELEVATION GROUND WATER IS. DATE HOLE VERTICAL MINCLINED 2/11/86 2/11/86 17. ELEVATION TOP OF HOLE 7. THICKNESS OF OVERBURDEN 47.5 18. TOTAL CORE RECOVERY FOR BORING S. DEPTH DRILLED INTO ROCK 4.0 19. SIGNATURE OF INSPECTOR S. TOTAL DEPTH OF HOLE REMARKS
(Drilling time, mater loss, measuring, etc., if algor SOX OR SAMPLE NO. CLASSIFICATION OF MATERIALS S CORE ELEVATION DEPTH LEGENO 40.€ 47.5 to 51.5 IMESTONE, brown, fine to coarse grained, argillaceous throughout isua with many stringers and dent thin seams noted, fossiliferous, in-place fractures noted, soft. T.D.-51.5' 0.9 51.5 60 m 70.0 ENG PORM 1836 PREVIOUS EDITIONS ARE OBSOLETE.

								Mole No. 8A4C-102
DRIL	LING LO	.	OUTHWESTERN	POR'	r WORT	'H	_	SHEET 1
GENER		NAMIC	cs	10. SIZE	AND TYP	E OF	SIT TTOK	8"AUGER, 4"CCRE
PALUX PALUX USCE	Y AQU	IPER	INVESTIGATION	12. MAN	UFACTUR			ING 1500
USCE L HOLE NO.			and state!	13. TOT	AL NO. OF			DISTURBED UNDISTURBED
HAME OF			8A4C-102		AL HUMBE			<u> </u>
BRE	WER			_	VATION G	_	0 44	YER ##
L DIRECTIO			D DES. FROM YERT.		E HOLE		2/	12/86 2/14/86
. THICKNES	S OF OVE	ROURDE	™ 60.5	_	VATION TO		_	V FOR BORING 86.3%
. DEPTH OF					ATURE OF	1918	7CT	OR / th
. TOTAL DE			80 . 0 CLAMIFICATION OF MATERIA		1 CORE	NO.	_	REMARKS
ELEVATION 4	DEPTH	LEGENO	(Peseriptim) 6		RECOV-	SA N	O.	(Brilling that, unter lean, depth of wanthering, era., if algoriticard)
	• •		0.0 to 0.2			1		1) Duming sugaring
			ASPHALT, good cond					1) During augering Free water encountere
			ASPIALL, good cond	11 610	ľ			@35.0ft. below grade.
	=		0.2 to 1.0±					Static water level taped at 34.0ft. below
			SAND, fine to coar	rse .	!			grade.
			grained, loose, dr	ту,	1	1 1		l E
			gravelly, brown.		l			
	\exists		1.0 to 6.5±		J] . [l E
						vi:		
Ì			CLAY, low plastic: soft, moist, grave			-		2) JARS
	٠٥. ٥]		calcareous, tan to					visual identification
}	- =		brown.					Visual Identification
			6.5 to 44.0+					<u> </u>
	∃		CLAY, low to mediu	ım.]		E
1			plasticity, soft t	:0				E
	=		stiff, moist to we along basal section			ļ	ı	
1	\Box		calcareous with li			}		E
	7		nodules and blebs					3) <u>DRILLING</u>
i	ヨ		especially from 31.0±34.0; becomin	g				0.0 - 60.5, 8"auger
ł	⇒		increasingly sandy	,				refusal at top of limestone primary.
ا	₽		below 39.0'to dept	n,				60.5 - 61.0. 7 ⁷ /8" E
	E		44.0 to 60.5					rock bit.
1	#		CLAY, medium to hi	ah.	,			61.0 -80.0, 4"core
ŀ	目		plasticity, stiff					to depth.
ļ	∃		hard in zones, wet					Remarks
ľ	⇉		calcareous, reddis	n-				A) Casing advanced to top of primary and
	Ξ					vic		reamed.
	긐		60.5 to 6'24			ide	nt	P) vocy of a grantegy
İ	∄		LIMESTONE					into primary and hole surged.
	日		60.5 - 61.4, bro	wn,				C) After coring, hole
	7		fine to coarse grained, strongl	,				bailed repeatedly unti
þ	»- Д		argillaceous, hig					nearly dry. Two 94145
]	∃		fossiliferous, so	ft.				bags of cement used to grout hole. Grout
]	크		$\frac{61.4 - 61.8}{61.00}$, tan					extended to
	∃	'	fine to coarse grained, arenace	ous.				approximately 55.0ft datum below grade.
1			moderately hard.					Casing subsequently
1	3		61.8 - 62.4 gra				[]	withdrawn.
ļ			fine grained, sli argillaceous, wel	ghtl				D) Boring backfilled
	=		cemented, hard.	•				with cuttings.
1	3		-					E) Ground water sample obtained for analysis.
j	╡							F) Boring offset
		- 1		ĺ			ιÍ	Saven feet due west

							Hole	No. 8A4C	=102
DRIL	LING LC		SOUTHWESTERN	HESTALL		1.7			T 2
I. PROJECT				10. SIZE	WORT	E OF BIT	8 "AUGER.	+"CORE	ante 18
GENERA!	DYN	AMICS		TI. DAT	JE POR E	EVATIO	SHOWN (1888 as	(100)	
PALUXY	AQUI	PER I	NVESTIGATION	12. MANI	UPACTURI	tr's oasi	SHATION OF DA	ILL -	
1 ORILLIMA USCE	AGENCY						G 1500	1	
4. HOLE NO.	(As short	-		12. TOT	AL NO. OF DEN SAMP	LES TAKE	EM O	:	O
B. HAME OF	DRILLER		8A4C-102		AL HUMBE				
BREWER				IS. ELE	VATION OF				
6. DIRECTIO VERTI			D DE6. PRGM VERT.	M. DAT	E HOLE		12/86	2/14/	
7. THICKNES				17. ELE	VATION TO	○P ○F HO	LE		
B. DEPTH DE					AL CORE		Y FOR BORING	94.3	
9. TOTAL DE	PTH OF	HOLE	80.0		R	R.A.	rdette		
ELEVATION	DEPTH	LEGENC	CLASSIFICATION OF MATERIA	14	S CORE	BOX OR		EMARKS	desch of
	<u> </u>				ERY	NO.	useathering.	etc., if election	(Scard)
	40.0	1		!		1 1	1		F
	=	1	62.4 to 63.1		Ì	1 1	ľ		
	Ξ		SHALE, dark brown,	,		1 1	ł		E
ì		l	laminated, arenace	ous,			ļ		E
		l	soft.	i		1 1	}		E
	=		63.1 to 66.5]		F
	=	Į				visus	1		F
]	Ξ		SAND, fine grained weakly camented,	4 9		iden	I		E
j			silty, calcareous			ĺ	[E
			throughout, light	gray		1			╞
	,,]		((, , , , , , , , , , , , , , , , , ,			1 1			F
1	50.0		66.5 to 77.6				1		E
			SHALE, dark brown, very thinly bedded						Ε
į	7		arenaceous, soft.	^•			1		⊨
	7]		F
	-3		77.6 to 80.0						F
]	=		SAND, fine grained	i. '		-	,		E
			with coarse grains	ed		[['			Ł
	3		sands noted, weakl cemented throughout			'			F
- 1	=		coarse grained	`''					E
İ	╡		uncemented zones	1					E
i	. =	1	throughout, silty, very soft.	•			i		E
ř	60. 0		1 101, 30100	- 1	410	RACK BE			F
Į	∃		m n 00 01	1		-	1		E
į		===	T.D80.0'				}		F
j	7	10400		J	0.0				F
}	彐			Ì					F
]	⊐			1	<u>64.8</u>	1			E
l	- コ			ĺ	65 46.5	•			E.
{	3			1					F
ĺ	7			ľ			1		E
(\exists			ì	ر ارو				E
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ì	3			1	71.5		1		E
}	\neg			j	40]		E
}	3				73.5		j		þ
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}	╡			Į	0.0		}		E
	30.oF			}	80.0	3			E
NG FORM	10 24				PROJECT			l HO	LE NO.

			 					Hele No.	31-133	
DRIL	LIME LO	••• 1 °	OUTHWESTERN	HISTALI	PORT #	(OB)	ጥዝ		OF 2 SHEETS	}
I. PAGJECT GENERA		AMICS	S	M. MIE	AND TYP	2 07	917	8"AUGER, 4"	CORE	7
PALUXY	AQUI		INVESTIGATION	12. MAN	UFACTUR	EN S	6 E Si	SHATION OF BRILL		4
USCE	AGENCY			<u> </u>				G 1500	! UNDISTURBED	1
A HOLE NO.	(Ac obs-		8A4C-103	II TOT	AL HOLOS	, S.	TAKE	0	0	1
L HAME OF	CALLER		(OX40-10)		AL HUMBE	_	_			7
BREW		LE			VATION 6				HPLETED.	-{
A VERTI		IMCL IN E		├	E HOLE				/19/86	4
7. THICKNES	8 OF OV	ERBURDE	DN 57.0		VATION TO				0.0%	-
L DEPTH OF			<u></u>		ATURE OF					Ħ
e, fotal De			65.0 CLASSIFICATION OF MATERIA		S COME	90X	K - 4	REMAIL REMAIL	RKS	┨
ELEVATION		LEGENC	(Description)		RECOV	200	PLE O		of local depth of	
	0.0_	1				1		1) During	augering	E
	_=		0.0 to 0.5]			free water	measured	E
	=	}	ASPHALT, good con	ditio	r.	1 1		# 35.0 ft. grade. Sta		E
		1	0.5 to 1.5±		}	1 1		level tape	ed at 36.5	
	Ξ	}	SAND, fine to coan		}	1		below grad	le.	E
	-	}	grained, loose, di		i	1 1				F
		}	gravelly, brown.			1 1				E
1	=	1								E
	Ţ	l	1.5 to 3.0 [±]		{	1 -	sua	_		F
		}	CLAY, low plastic:			iid	ent	•		E
	10.0	1	sandy, gravelly,			1 1				F
,	_ =	}	to brown.				- 1	2) <u>JARS</u>		F
	-	•	3.0 to 10.6±			[visual iden	tification	F
	=		CLAY, medium to h	l an		1 1				F
1	П		plasticity, stiff							E
	- =		moist, sandy, gra-	velly	•		1			E
i			calcareous with li nodules and seams	ımy			- 1			E
Ì	╡		in section, reddis	sh-			- 1			E
}			brown.				i	3) DRILLIN	iG	F
1	=	i	10.6 to 27.0*			ii	- 1	0.0 - 57.0		·Ε
}.	20.0		CLAY, low plastic	itv.		1)		F
}	∄		soft, moist, sand				- 1			E
(throughout with a					57.0 - 65.	.0, 4"core	E
}	3		strong sand fract: noted @ 21.0223.0	: 1	,		uai	to depth.		F
(크		gravels noted 224.	0'to	. 4		nt	Remarks:	د - د مدمود د م	E
· · · · · · · · · · · · · · · · · · ·	3		tan.			} }	}	A) Casing to top of p	rimary:	F
1	3							boring sur		E
į	hilini		27.0 to 33.0 [±]	į			ļ	B) After o		æ
j	크		CLAY, medium to h	igh			- {	bailed repuntil near		E
1	#		plasticity, stiff moist, calcareous					94 1b bag	of cement	:
}	30.0		with limy nodules	and]	used to gr Grout exte	out hole.	Es+
ļ	=		blebs in section, reddish-brown.	ł			l	5 feet abo	ve primar	
]]			})	contact. (JE.
ì	日		33.0 to 57.0))	C) Boring	-	-
1	_=		CLAY, low plastic				ł	backfilled		F,
J	\exists		soft, moist, sand throughout,calcar				Į	cuttings.		E
}	╡		tan.	2 V U B	1			D) Bering		E
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MG FORM					PROJECT	4			HOLE NO.	

8A4C-103 STALLATION DRILLING LOG FORT WORTH of 2 SHEETS SOUTHWESTERN 10. SIZE AND TYPE OF SIT 8 "AUGER, GENERAL DYNAMICS PALUXY AQUIFER INVESTIGATION

ORIGINAL AGENCY
USCE IL MANUPACTURER'S DESIGNATION OF BRILL FAILING 1500 0 13. TOTAL NO. OF OVER-HOLE HO. (As als 8A4C-103 IL TOTAL NUMBER CORE BOXES HAME OF BRILLES IL ELEVATION GROUND WATER M. DATE HOLE 2/18/86 TVERTICAL MINCLINED 17. ELEVATION TOP OF HOLE . THICKNESS OF OVERBURDEN 57.0 19. TOTAL CORE RECOVERY FOR SORING 70.0% DEPTH DRILLED INTO ROCK 8.0 R.R.A udetta TOTAL DEPTH OF HOLE 65.0 BOX OR SAMPLE NO. REMARKS CLASSIFICATION OF NATERIALS ELEVATION DEPTH 40.0 57.0 to 60.5 CLAY-SHALE, tan to greenish-gray, calcareous, soft. 60.5 to 61.6 LIMESTONE, tan to gray fine to coarse grained visual arenaceous, weathered, ident. siliceous zones noted in section, fossiliferous moderately hard. 50.0_ 61.6 to 62.4 SHALE, dark brown, laminated, arenaceous, soft. 62.4 to 65.0 SAND, fine grained, weakly cemented throughout, calcareous very silty, becoming 57.0 2.0 59.0 strongly argillaceous below 63.8' to depth; light gray to brown along basal section. å.5 60.0 1 ٥.0 T.D.-65.0' 70.0 .0 NG FORM 1836 PREVIOUS EDITIONS ARE OSSOLETE.

CENERAL LOCATION	AQUIP	MICS		10. 9178	WORT	OF ":"	S"AUGER	SA 4C-104 SHEET 1 OF 1 SHEETS	
GENERA LOCATION PALUXY SORILLIMO USCE MOLE NO.	L DYNA	MICS		10. 9178	-	OF ":"	S"AUGER	10	ł
E LOCATION PALUXY SORILLING USCE A HOLE NO. (A HOLE NO. (AQUIP	or \$4.		II. DAY	POR E	EVATION			J
PALUXY S. ORIGINAL USCE 4. HOLE NO. (AGUIF			ľ				•	
USCE			NVESTIGATION	12. HAN	PACTURE	WE DES	SNATION OF BAILL		ł
S. HAME OF D	A				1	AILI	NG 1500		J
	-	-	ng Hillo	13. TOT	NEW BANK	.es yakı	M O	0)
	A11 1 44		8A4C-104	14. TOT	-	A CORE	OKES 1		1
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s. DIRECTION				H. DATI	I HOLE			2/20/86	1
ZVENTIC	AL DING	LINED	DEG. PROM VERT.	IZ. BLEV	ATION TO			6.27	1
7. THICKNESS							Y FOR BORING	,	1
B. DEPTH DRI			<u></u>	19. SIGN	ATURE OF	Aud	TOR HD		1
S. TOTAL DE	PTH OF HO		40.7		a cone		REMA	AKS	ł
	DEPTH	GEND	CLAMIFICATION OF MATERIA (President)			SAMPLE HO.	(Drilling time, man	er loss, depth of if eignificant	1
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1 1	ㅋ	ł					grade.		E
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j (• • • • • • • • • • • • • • • • • • • •	į	2.5 to 35.7			visua	F		上
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	-	}	soft, moist to we	t			2) JARS		E
1	Ξ	- }	along basal zone, calcareous with 1	inv			visual ide	ntificatio	E
		}	nodules and blebs				115441 146		E
1	⇉	}	section, sandy wi			} }]		F
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1	=		fine to coarse gr	ained			3) DRILLI	<u>NG</u>	E
1	ヸ	- 1	prominent fractur	e		1 1		7, 8"auger	E
:	20-0		noted @ 36.7; siliceous, highly				refusal a		上
	7	ĺ	fossiliferous in			11			F
l j	_=	ļ	section, moderate	ly		1 1	35.7 - 40. to depth.	7, 4"core	F
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	3	J	T.D40.7°				Remarks:		E
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1	Ε_	}					bailed re	peatedly rly dry. C	E
	3	ŀ	16					of cement	
	<u>, </u>	l					used to g	rout hole.	
	المحود	ı					Grout ext		F
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	40.0				40.1			· 	F
ENG FORM	1836 -	IE VIOL	IS EDITIONS ARE OGROLETE.		PROJECT			HOLE NO.	

Hole No. 84-105 METALLATION FORT WORTH DESLLING LOG SOUTHWESTERN M. MEE AND TYPE OF MY 8"AUGER THE REST GENERAL DYNAMICS PALUXY AQUIFER INVESTIGATION 12. MANUPACTURER'S DESIGNATION OF ORILL PAILING 1500 USCE
L HOLE NO. (As shown as dearing title and Electronical) 13. TOTAL NO. OF OVER-8A-105 E MANUEL OF ROLL & ST IS ELEVATION GROUND WATER BREWER DIRECTION OF HOLE 2/21/86 IS. DATE HOLE 2/21/86 ZOVERTICAL | INCLINED. 17. ELEVATION TOP OF HOLE 57.0 7. THICKNESS OF OVERBURDEN 18. TOTAL CORE RECOVERY FOR BORING B. DEPYN DRILLED INTO ROCK 0.0 M SIGNATURE OF IMPRECTOR R.R. Andette 57.0 REMARKS
(Drilling time, water less, depth of smallering, ere., if significant) RECOVE SAMPLE CLASSIFICATION OF MATERIALS 0.Œ 1) During augering 0.0 to 0.6 free water encountered @ 36.0ft. below ASPHALT, good condition grade. Static water level taped # 34.5ft. below grade. 0.6 to 2.4± SAND, fine to coarse grained, loose, dry, gravelly, brown. 2.4 to 54.0 ± isua ldent CLAY, low to medium plasticity, soft to 2) JARS g Hillindini stiff at depth, moist visual identification to wet at depth, calcareous with limy nodules and seams in section, sandy throughout especially 11.0-14.0; 19.0'-25.0' light gravels noted 943.0-44.0; tan. 54.0 to 57.0 3) DRILLING 0.0 - 57.0, 8"auger refusal at top of CLAY, medium to high plasticity, stiff, wet, calcareous, 20 -0 limestone primary. Fragments of limestone slightly gravelly, reddish-brown. noted on stinger. 57.0 risua LIMESTONE, (auger identi refusal on top of limestone). T.D.-57.0' 40.0 ENG FORM 18 36 PREVIOUS EDITIONS ARE OSSOLETE.

OUS EDITIONS ARE CHIDLETE (TRANSLUCENT)

Male No. Bn-105

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DRILL	ING LOC		vision OUTHW	ים ביי ב	N .		ALLATIC RT W						or 2	T Z SHEET!
MOJECT				باد <u>ت د بین</u>		10. 8	ZE MIC	TYPE	OF BI	+81	AUGER			
ENERA	L DYN	MICS				11. 8	AYUN	OF EL	EVATE	OM 8	HOUN (TE	7 e M)	
PALUXY	AQUI			IGATI(ON	12. 1	ANUFAC				ATION OF	BAILL		
JSCE	AGENCY							P/	ILI	NG	1500			
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MANE OF C				8.4	-105	14. 7	OTAL N	JMOC	R CORE	. 80	<u> </u>			
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DIRECTION						16. 0	ATE HO	LE	2	/21	/86	19	/21/	86
VERTIC					6. PROM V		LEVATI	OH TO		_			7 7	
THICKNESS					7.0	10. 7	OTAL C	ORE I	ECOVE	RY		HQ	-	
DEPTH ON					<u> </u>	79. 5	UTAND	RE OF	R.R.		dette			
TOTAL DE			<u> </u>		7.0	PERIAL S	3.0	390				REM	ARKS	
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			ASION	MISTALL	ATION			8n-106
	LIMS LO	_	OUTHWESTERN		WORTH	<u> </u>		OF 2. SHEETS
PROJECT				ID. SIZE		07 SIT	8"AUGER	
GENERA LOCATION	Cameria	ares ur Jea		`` ```	vert EL		mo-4 (100 @ 10	_
PALUX	Y AQU	IFER	INVESTIGATION	12 WAR			SHATION OF GRILL	
USCE			÷	12 700			G 1500	UNGISTURGED
HOLE NO.	(An air-		W MIO	- 606	MEN SALES	LES YAKE	0	0
HAME OF	DRILLER		8A-106		N. HUMBE			
BREWE	R		· · · · · · · · · · · · · · · · · · ·	-	/ATION OF			
DIRECTIO			DEG. FROM VERT.	M. DAT	E HOLE	,	4/86	3/4/86
Z venti				17. ELE	ATION TO			76.82
THICKNES			<u></u>				Y FOR BORING	,
DEPTH DE			0.0	19. SIGN	ATURE OF			
TOTAL DE		HOCE T	61.0		1 CORE		udette	ARKS
EVATION.		FEGENO	CLAMIFICATION OF MATERIA		RECOV-	SAMPLE HO.		ater loss, depth of
•	0.0	┝╌┤			-	\	 	1
1	-				l	[1) Durina	augering
	_=	[Ì	0.0 to 0.7		1			er measure
]	_] [ASPHALT.good cond	ition	}]]	at 35.01	
	Ξ						grade.	
- 1	-	l /	0.7 to 1.8 t				- Static	water leve
}	=	j	SAND, fine to coa	rga			taped at	33.5 ft.
ĺ	_=	[[grained, loose, d	rv.		[[below gra	de.
- 1			clayey, brown.	- , ,			 	
ł							ł	
ĺ			1.8 to 8.0 [±]					
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1	10.0		CLAY, low to medi- plasticity, soft,		t.	visus		
	40.0	[slightly gravelly		• •	ident	ļ.	
ļ	=		calcareous, tan t			'	2) <u>JARS</u>	
1		[brown.			i i i	visual id	lentificati
1	3							
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			SAND, fine to com	rse			{	
	\equiv]	grained, loose, m	oist,]]	ļ	
	_		very clayey throu	ghout	•	,		
- 1	\exists		calcareous, tan.			1 1	ו זדמו (2	TNC
ļ	3		العاد الماما				3) <u>DRILI</u>	
	=		10.5 to 14.02] [0, 8"auger
ĺ	_ ∃	}	CLAY, low plastic			1	refusal a	it top of e. Fragment
ļ	50 Q		soft, moist, very					one noted
	7		sandy throughout, calcareous, tan.				on stinge	
J	\exists	.	CTICAL BOND! CALL!]]]	
J	=	1	14.0 to 16.5+				1	
- 1	3	ŀŀ				visu	1	
J	-3	j	SAND, fine to coa			iden		
j	milini	, ,	grained, loose, m		_	'		
- 1	3	1	very clayey throu calcareous, tan.	Ritoria	•		}	
1	3	. 1	Ammany change with	9				
ĺ	\exists	- 1	16.5 to 44.0±			1 1	l	
ļ	\exists	1					j	
Į	\exists	. 1	CIAY, low to medi	um [
ł	· <u> </u>	1	plasticity, soft stiff along basal				{	
ļ	\exists	- 1	calcareous with 1		•		1	
ĺ	\exists	ſ	seams and nodules					
ļ		- 1	throughout, sandy	,]	
ł	E	1	gravel seam noted			1		
į	_=	- 1	à 27.0±28.0; tan.					
j	\exists	j	44.0 to 52.0±	ļ				
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l		- 1	CLAY, medium to h	ıgh				
1	7		plasticity, stiff wet, calcareous w					
- 1	ヸ	1	limy seams and no					
}	7	J	throughout, reddi		ļ		}	
\ \ \ \ \	⇉	J	brown.				1	
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											<u>de No.</u>	8 <mark>4 - 1</mark> 06	
Dest	LING LC		SOUT	HWESTERN	1	BORM.	MORTH			_		SHEET	
I. PROJECT				11,,001,001	\dashv	10. MZE	AND TYPE	07	MT.	auger			
GENER L LOCATION	AL DY	NAMIC	S]	II. BAY	POR EL	EVA	1011	BOOK TO	(a)		$\neg \neg$
PALUX	UCA Y	IFER	INVE	STIGATION	1	12 203	W ZETUR	178 E	147	HATION OF	Bailt		
	AGENCY									ING 150	10		
USCE	(Ao atom		110 0		\dashv	12. TOT	# 18 OF	84	AKE	DISTURB	LO	UNDISTU	960
***				8A-106			AL HUMBE			<u> </u>		<u> </u>	
BREW							VATION OF				**		
a sinectio	H OF HOL					M. DAT		1	BTA	RTED		LETED	
-	em 🖂	MCLIMES	·—-	DEG. FROM Y	ERT.					4/86		<u>/4/86</u>	
7. THICKNES	8 OF OVE	ERBURDE	30	61.0	$\overline{}$		VATION TO		_				
. DEPTH OF				0.0			AL CORE I			FOR BORIS			<u> </u>
S. TOTAL DE	PTH OF	HOLE		61.0		12	Ŕ	· 7		datte			
ELEVATION	DEPTH	LEGENO	,	LASSIFICATION OF MA	TERIA	u	S CORE	BOX SAME			REMA	RICE	
•			Ì	(Procestycom)			TOTAL TOTAL	*		7	-	e laca, days if elignidica	5"
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NG FORM	1836	PREVIOU	5 COITI	ONS ARE OGSOLETE.			PROJECT			_		HOLE	HQ.

								Hale No	8a-107	
	LING LO	×	SOUTH	WESTERN	FOR	T WORT			or 2 sheets	
GENERA	L DYN				In. SIZE	AND TYP	07 811	8 "AUGER		
L LOCATION	/Comits	-	-	TIGATION		** ** : :::		MATION OF BAIL		ļ
S BRILLING USCE	AGENCY	FER	111 7 202	7110K110K	T	F	AILI	NG 1500		•
4 HOLE HO.	(As show				12 707	AL MOLOS	LES YAK	EM - 0	UNDISTURBED	}
S. HAME OF				: 8A-107		AL HUMBE				1
BREWER			<u> </u>		+	VATION OF				į
∰vent.				DEG- FROM VEA	*	E HOFE	3	/5/86	3/5/86	ł
7. THICKNES	6 OF OV	ROURO	C 31	61.0		VATION TO		ty for soning	647.37	ł
B. DEPTH OF			×	0.0		ATURE OF	HAPES	TOR	-	1
B. TOTAL DE		T T	1 .	61.0	PIALS	y cone		edette .	AARKS	ł
ELEVATION 4	DEPTH	LEGEN	י	CLAMIFICATION OF MATE (Description)		RECOV-	10.	(Drilling time, or	ester leas, depth of the if elgerificant	
	0.0		1				1	1) Junio	ng augering	E
	=	t	0.	0 to 0.6		ł	1 1	free wate	er encounter	₫d
		}	AS	PHALT, good co	nditio	ተ		grade.	. below	E
	=		0.	6 to 1.4±		l		-Static	water level	F
	1	1	. –	ND, fine to co	arse	ł		taped at below gra		E
	_=		gz	ained, loose, ayey, brown.						E
						•	[E
! !	_=		_	4 to 6.5±				2) JARS		E
			CI	AY, low plasti oft, moist, sar	city,			· —	dentificati	E
	10 -0			lcareous, tan.			ĺ .'	1	2011011120-02	Ë
			1 6.	5 to 9.0			visu iden			E
	3		_	AVEL, fine gra	ined.					E
	Ξ		ar	igular to suban	gular,		[]	3) DRILL	ING	F
1	Ξ			oose, moist, cl ery sandy, calc		L			.0, 8"auger	E
	_ =			in.		ľ			with auger at top of	F
	Ξ		١ .	0 to 13.0±		ĺ		limestone	. Fragment:	Ł
	₹			AY, low plasti	city.		}	of limes on stinge	tone noted	E
	三		80	oft, moist, ver	' У					E
	E			indy throughout ilcareous, tan.						F
	20+0		1				visu	I,		E
	=		. –	3.0 to 15.5 ^T	ad.		iden	. –		E
1			10	<u>ND</u> , fine grain lose, moist, ve	ry			ļ		E
1	3			layey throughou Llcareous, tan.		!]		E
			1		•			ł		E
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ļ	크			<u>AY</u> , low to med asticity, soft						E
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			NVISION			INSTAL			<u>Hol</u>	e No.	8n-1	07	
	LING LO			WESTERN			WORTH	1			SHERT OF 2	2 SHEETS	ł
I. PROJECT									8 AIGER				1
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7. THICKNES	5 or ov	ERBURG	E M	61.0		-	VATION TO		Y FOR BORING				1
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ING FORM	18 24			ONS ARE OGSO			PROJECT				100	.E NO.	

Hole No. 8A-108 DRILLING LOG PORT WORTH OF 2 SHEETS SOUTHWESTERN a let W. SIZE AND TYPE OF SIT 8 "AUGER GENERAL DYNAMICS PALUXY AQUIPER INVESTIGATION
CONT. LINE ASSICT
USCE
HOLE NO. (As shown as downing total) 12. MANUFACTURER'S DESIGNATION OF BRILL PAILING 1500 13. TOTAL NO. OF OVER-0 0 8A-108 14. TOTAL NUMBER CORE BOXES A HAME OF BRILLER IL ELEVATION GROUND WATER 3/6/86 3/6/86 MVERTICAL MINCLINED 17. ELEVATION TOP OF HOLE -- 648,82 48.0 7. THICKNESS OF OVERBURDEN M. TOTAL CORE RECOVERY FOR SORING L DEPTH DRILLED INTO ROCK 0.0 19. SIGNATURE OF INSPECTOR udatta 48.0 REMARKS RECOVE SAMPLE CLASSIFICATION OF MATERIALS (Drilling time, unter love, depth of weathering, etc., if eignificant) DEPTH LEGEND 0.0 1) During augering 0.0 to 0.6 miniment of second and and an inclination of the second and an inclination of the second and an inclination of the second and an inclination of the second and an inclination of the second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second a second and a second and a second and a second and a second and free water measured ASPHALT, good condition at 37.0ft. below grade. 0.6 to 2.5 -Static water level taped at 34.0ft SAND, fine to coarse below grade. grained, loose, dry, clayey, brown. 2.5to 9.5± visual GRAVEL, fine to coarse grained, angular to subangular, loose to ident. 2) JARS medium dense, moist, visual identificati clayey, sandy, tan. 9.5 to 12.5 SAND, fine grained, loose, moist, clayey, 3) DRILLING

0.0 - 48.0, 8"auger refusal with auger scraping at top of limestone. Fragments of limestone noted on stinger. calcareous, tan. .3) DRILLING 12.5 to 17.5* CLAY, low to medium plasticity, soft to stiff, moist, sandy, tan. 17.5 to 19.0[±] visual ident. SAND, fine grained, loose, moist, very clayey, tan. 19.0 to 21.0± CLAY, low to medium plasticity, soft to stiff, sandy, tan. 21.0 to 23.5 SAND, fine grained, loose, moist, clayey, slightly gravelly, tan. 23.5 to 48.0± CLAY, medium to high plasticity, stiff, moist to wet along basal section, calcareous with limy nodules and blebs in section, tan.

ENG FORM 1836 PREVIOUS EDITIONS ARE OBSOLETE.

MSYALLATION DRILLING LOG SOUTHWESTERN FORT WORTH 10. SIZE AND TYPE OF BIT 8 "AUGER GENERAL DYNAMICS
LOCATION (Constitution or Sention)
PALUXY AQUIPER INVESTIGATION
ORNLING AGENCY
USCE 12. MANUPACTURER'S DESIGNATION OF DRILL IS. TOTAL NO. OF OVER-0 8A-108 14. TOTAL HUMBER CORE BOXES HAME OF DRILLER IL ELEVATION GROUND WATER BREWER 3/6/86 3/6/86 TVERTICAL MINCLINED 17. ELEVATION TOP OF HOLE 48.0 7. THICKNESS OF OVERSURDEN DEPTH DRILLED INTO ROCK R.A . TOTAL DEPTH OF HOLE 48.0 CLASSIFICATION OF MATERIALS LEGEND DEFTH 48.0 LIMESTONE, ( auger refusal at top of visual ident. limestone). T.D.-48.0' 80.0 BNG FORM 18 36 PREVIOUS EDITIONS ARE OSSOLETE.

Hole No. SASP-109

		DIV	HION	INSTALL	HOITA				T I
	ING LO		UTHWESTERN		WCRTH		A 1 16 5		2. SHEETS
PROJECT				10. SIZE	MID TYPE	EVATION	34"PISHT	LIL	
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ALUXY	AQUI	PER IN	VESTIGATION	12 MANU	PACTURE		SHATION OF DR	LL	
USCE	MENCY				4 10 05		ING 1500	l unio	STURBED
HOLE NO. (	A		d title	S TOTA	L HO. OF	ES TAKE	0	•	0
HAME OF D			BA3F-109		L NUMBE				
			•	IL ELEV	ATION 6			**	
BREVER	OF HOL	4		H. DATE	HOLE		/6/86	3/6/	186
X VERTIC	AL	HCLINED	DEG. PROM VERT.	13 51 51	ATION TO			47.2	
THICKNESS	OF OVE	RSURDEN	47.5				Y FOR BORING	<del>~ /. 2</del>	<del></del>
-	LLED IN	TO ROCK	2.0		ATURE CF				
TOTAL DE	PTH OF	+OLE	49.5						
LEVATION	DEPTH	LEGENO	CLAMIFICATION OF MATERIA	LE	RECOV-	BOX OR	(Druling time	EMARKS	, depth of
•			1		ERY	HO.	incomorting.	ote, if old	
_ <u>`</u> _	0.0					下下	1) Free	water	r
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1		1	ASPHALT, good con	ditio	h	1 1	static	water	levels
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J	7		0.5 to 2.0 [±]		1		Į		
1	⊣	1	SAND, fine to co	arse	1		]		
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j		1	clayey, brown.		)	] ]	]		
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ļ	=		2.0 to 35.0 [±]		<b>,</b>	{ }	1		
]	_	<i>,</i>	CLAY, low to med		]				
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:	10.4		sandy, calcareou tan(logged by cu	tting	B)	1 1	visual i	•	ficatio
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ľ	=		35.0 to 47.5 ±			1 1	1		
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ì	=	)	plasticity, stif	f.	}	vis			
[	_	ĺĺ	calcareous, redd	ish-	i	iden.	4		
ļ	_		brown(logged by		1				
j	=	j j	cuttings).		) .				
i	7	[	47.5 to 49.5		]		3) DRII	LING	
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			LIMESTONE, brown gray, fine to co	arsa	J				depth.
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Hole No. SASF-104

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PROJECT		1111	4 - 11 T First - 11 11 11 11 11 11 11 11 11 11 11 11 1				34"2151	ተል ተ፣	, onti	
GENER	AL DYNA	MICS		TI. DAY	N FOR E	LEVATIO	3 PIS			_
			VESTIGATION							
DRILLING	AGENCY	V TIM	VESTIGATION	12. MAN			NG 1500	De.FF.		
USCE				13. TOT	AL NO. OF			•	UNDISTURSE	10
HOLE NO.	(As about on	drowing	8A3F -109	BUR	DEN SANP	LES TAK	0		0	
HAME OF			-470A		AL HUMBE			-		
BRE	WER			IL ELE	VATION G			**		
DIRECTION	OF HOLE			H DATE	E HOLE	97	/4 /94	I CO	16 /86	
X VERTIC	AL DINCE	IMED _	DEG. PROM VERY.	<b></b>			/6/86		/6/86	_
THICKNES	OF OVERSE	ROEH	47.5		ATION TO					
DEPTH OR	ILLED INTO	ROCK	2.0		ATURE OF		Y FOR SORIN		<u> </u>	<u></u>
TOTAL DE	PTH OF HOL	£	49.5				•			
LEVATION	050-11	EHO	CLASSIFICATION OF MATERIA	LS	S CORE	BOX OR		REMA	tks	_
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DRIL	LING LOG	<u> </u>	VISION	POP	ATION T	nu.		SHEET I	1
1. PROJECT			SOUTHWESTERN	10. SIZE	AND TYP	OF BIT	8"AUGER 32		1
	L DYNA			11. BAT	JII FOR E	EVATIO	SHOWN (THE & THE		1
PATIUXY	AQUITE	PER 1	INVESTIGATION	18 414	WEAT - 10 V		MATION OF SHILL		4
3 ORILLING							NG 1500		1
USCE NO.	(An about		na wial	19. TOT	AL HO OF		DISTURBED	UNDISTURBED	1
			8A3F-110	<b></b>	AL NUMBE		i	<u>:                                    </u>	-
S. HAME OF					VATION 6				1
BREWE	M OF HOLE					187	ARTED ICO	MPLETED	┨
- VERTI	CAL     14	CLINEO		M. DAT		13	/13/86		1
7. THICKNES	S OF OVER	ROURDE	w 46.0		VATION TO			7.22	1
e. DEPTH DI	ILLED INT	O ROCK			ATURE OF		Y FOR SORING _	<u>-                                      </u>	4
S. TOTAL DE	EPTH OF H	OLE	238.0	1	R	RA	dette		
ELEVATION	DEPTH L	EGEND	CLASSIFICATION OF MATERIA	4	S CORE	BOX OR	(Drilling time, wat	RKS	7
		•	4		ERY	NO.	Protecting, etc.,	or loos, depth of it significant	1
	9.9-					<b>1</b>	4)		F
	7		0.0 to 0.4		!	1 1	1) During		Ŀ
			ASPHALT, good con	41+10	_			er measure below grad	
	E	ļ	PRESENTE BOOK COU	010	Ι.			ater level	
j i	]	]	0.4 to 1.7 ±		l		taped at	32.8 ft.	E
<b>\</b>	=======================================	1			l	} }	below gra	de.	E
	=	1	SAND, fine to coa grained, loose, d	rv.	l		!		E
			gravelly, clayey,	- J <b>T</b>			1		F
	milini		brown.				1		F
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	7	- 1	1.7 to 5.3 [±]			<b>!</b>	2) <u>JARS</u>		F
	,,⊒		CLAY, low plastic	ity,		1	visual ide	ntificatio	· <b>F</b>
	10-0	- !	soft, moist, grav	elly					F
	=	l l	sandy, calcareous	•		visu	L,		E
			tan.			iden			E
	∄		5.3 to 35.0				}		E
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1	=		CLAY, medium plas	tici	У• .		3) DRILLII	1G	E
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l· i	「 <b>コ</b> .	İ	along basal secti	on,			refusal a		<b>=</b>
	=		sandy along topmo				coarse bas	sal gravel	· <b>F</b>
j	$\exists$		section with stro arenaceous zones				4"i.d. cas		F
1	Ⅎ		a 11.0-14.0: 16.0	-18	5'		at top of	gravels.	Ε
	20.0		calcareous with 1				Annulus fi bentonite		
	- " = 1		nodules and blebs section. tan.	in				. •	E
]	7		section, tan.			l	35.0 - 230 fishtail	to depth.	F
l i	$\exists$	İ	35.0 to 46.0			visua ident	<u> </u>		⊨
	$\exists$						Vemer.var		Ė.
	$\exists$	ı	GRAVEL, coarse gr very dense to har		•		A) No hydi in drilli:		
	Ξ	ŀ	wet, sandy, tan t				upper and		E
	ゴ		gray (logged thro	ugh			Paluxy to	top of	E
i i	⇉	1	cuttings and dril action)	T ]	· ·		Glenrose		E
	⇉	l	ac atom)				exceptions 104.0-104	98.0-98	1
	ㅋ		46.0 to 57.0.+				109.5-111	.0.126.6-1	27.4
	7				Ĺ		173.5-176	.3.	F
	30 <del>. 0</del>		LIMESTONE, tan to fine to coarse gr				B) 240 ft	of tremie	F
	$\exists$	J	soft.(logged thro		•		pipe adva		E
	E		cuttings and dril	1			depth.		E
	Ⅎ	ļ	action).				c) twenty		E
	⇉	i					ninety-for		E
	⇉	1	57.0 to 58.5				cement use	ed in grou	ine
	#		SHALE, gray to da	rk			hole from	depth to	F
	ヸ		gray., silty, sof	ţ ^			grade us:	ing a rati	<u></u>
	$\exists$	Į	in section, (logge through cuttings				of 7 to 7 water to		
]	三	Ì	E-1dgging).					te: a 1:6	
	30 <del>.0</del>	ļ					ratio att	empted,	F
	40.0	ļ					viscosity	too high	For
ENG FORM			S EDITIONS ARE OSSOLETE.		PROJECT	L.¥	mixing an	paratus   HOLE NO.	
MAR 71	.0.30	MEVIOU	S EURTIONS AND DESCRIPTE.	l l				1	

Hole No. SA3F-110 SYALLATION DEILLING LOG SOUTHWESTERN FORT WORTH OF 6 SHEETS 11. BAYUN FOR ELEVATION THOSE OF MEAN THE CONTROL OF MEAN THOSE OF MEAN THOSE OF MEAN THOSE OF MEAN THOSE OF MEAN THOSE OF MEAN THOSE OF MEAN THOSE OF MEAN THOSE OF MEAN THOSE OF MEAN THOSE OF MEAN THOSE OF MEAN THOSE OF MEAN THOSE OF MEAN THOSE OF MEAN THOSE OF MEAN THOSE OF MEAN THOSE OF MEAN THOSE OF MEAN THOSE OF MEAN THOSE OF MEAN THOSE OF MEAN THOSE OF MEAN THOSE OF MEAN THOSE OF MEAN THOSE OF MEAN THOSE OF MEAN THOSE OF MEAN THOSE OF MEAN THOSE OF MEAN THOSE OF MEAN THOSE OF MEAN THOSE OF MEAN THOSE OF MEAN THOSE OF MEAN THOSE OF MEAN THOSE OF MEAN THOSE OF MEAN THOSE OF MEAN THOSE OF MEAN THOSE OF MEAN THOSE OF MEAN THOSE OF MEAN THOSE OF MEAN THOSE OF MEAN THOSE OF MEAN THOSE OF MEAN THOSE OF MEAN THOSE OF MEAN THOSE OF MEAN THOSE OF MEAN THOSE OF MEAN THOSE OF MEAN THOSE OF MEAN THOSE OF MEAN THOSE OF MEAN THOSE OF MEAN THOSE OF MEAN THOSE OF MEAN THOSE OF MEAN THOSE OF MEAN THOSE OF MEAN THOSE OF MEAN THOSE OF MEAN THOSE OF MEAN THOSE OF MEAN THOSE OF MEAN THOSE OF MEAN THOSE OF MEAN THOSE OF MEAN THOSE OF MEAN THOSE OF MEAN THOSE OF MEAN THOSE OF MEAN THOSE OF MEAN THOSE OF MEAN THOSE OF MEAN THOSE OF MEAN THOSE OF MEAN THOSE OF MEAN THOSE OF MEAN THOSE OF MEAN THOSE OF MEAN THOSE OF MEAN THOSE OF MEAN THOSE OF MEAN THOSE OF MEAN THOSE OF MEAN THOSE OF MEAN THOSE OF MEAN THOSE OF MEAN THOSE OF MEAN THOSE OF MEAN THOSE OF MEAN THOSE OF MEAN THOSE OF MEAN THOSE OF MEAN THOSE OF MEAN THOSE OF MEAN THOSE OF MEAN THOSE OF MEAN THOSE OF MEAN THOSE OF MEAN THOSE OF MEAN THOSE OF MEAN THOSE OF MEAN THOSE OF MEAN THOSE OF MEAN THOSE OF MEAN THOSE OF MEAN THOSE OF MEAN THOSE OF MEAN THOSE OF MEAN THOSE OF MEAN THOSE OF MEAN THOSE OF MEAN THOSE OF MEAN THOSE OF MEAN THOSE OF MEAN THOSE OF MEAN THOSE OF MEAN THOSE OF MEAN THOSE OF MEAN THOSE OF MEAN THOSE OF MEAN THOSE OF MEAN THOSE OF MEAN THOSE OF MEAN THOSE OF MEAN THOSE OF MEAN THOSE OF MEAN THOSE OF MEAN THOSE OF MEAN THOSE OF MEAN THOSE OF MEAN THOSE OF MEAN THOSE OF MEAN THOSE OF MEAN THOSE OF MEAN THOSE OF MEAN THOSE OF MEAN THOSE OF MEAN THOSE OF MEAN ENERAL DYNAMICS PALUXY AQUIFER INVESTIGATION 12. MANUFACTURER'S DESIGNATION OF ORILL FAILING 1500 USCE 12. TOTAL NO. OF OVER-HOLE HO. (As shows on dearing title 8A3F-110 IL TOTAL NUMBER CORE BOXES HAME OF DRILLER IS ELEVATION GROUND WATER BREWER ** 3/18/86 M. DATE HOLE 3/13/86 X VERTICAL TINCLINED DES. PROM VERT 17. ELEVATION TOP OF HOLE 7. THICKNESS OF OVERSURDEN 46.0 18. TOTAL CORE RECOVERY FOR BORING DEPTH DRILLED INTO ROCK 92.0 R.R. A. . TOTAL DEPTH OF HOLE 238.0 RECOV-BOX OR SAMPLE NO. CLASSIFICATION OF MATERIALS REMARKS ELEVATION DEST LEGENG 10.OL D) After 19 bags used in grouting, 58.5 to 61.2 an initial grout SANDSTONE, very fine grained, silty. level of 2. Oft below grade was noted. calcareous, soft. Tremie pipe was (logged through cuttings and E-log). subsequently removed. A final grout level of 10.0ft below grade was noted at plus 61.2 to 73.0± 20 hours. An additional SHALE, dark gray, arenaceous with One-half bag of cement was used to grout to grade using the same 1:7 grout abundant sandstone seams and stringers in section, soft. ratio. (logged through E) All auger cuttings cuttings and E-log). visual were removed and visual stored in sample bags. ident. 73.0 to 85.5 P) Two samples of SANDSTONE, fine to coarse grained, silty, drill water obtained for analysis by SWD calcareous, shaly with inferred shale stringers and seams, soft. (cuttings and G) Boring offset 7.071. E-log). ے۔ 85.5 to 106.0² SHALE, dark gray, inferred sandstone stringers and seams in section, soft. (logged through E-log and cuttings). visual 106.0 to 112.0 ident SANDSTONE, fine grained, silty, calcareous, inferred shale stringers in section, soft.(logged through cuttings and E-log). 112.0 to 166.0[±] SANDSTONE, fine to coarse grained, silty, calcareous, soft. (logged through E-jog and cuttings). 166.0 to 167.5 SHALE, dark gray, soft. (logged through E-log). ENG FORM 18 36 PREVIOUS EDITIONS ARE OSSOLETE.

STALLATION OF 6 SHEETS DRILLING LOG SOUTHWESTERN PORT WORTH M. SIZE AND TYPE OF MY 8"AUGER, FISHTAIL DYNAMICS PALUXY AQUIPER INVESTIGATION 12. MANUFACTURER'S DESIGNATION OF DRILL FAILING 1500 11. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN 0 8A3F-110 14. TOTAL NUMBER CORE BOXES IS. ELEVATION GROUND WATER 3/13/86 3/18/86 ZVERTICAL MINCLINED 17. ELEVATION TOP OF HOLE 7. THICKNESS OF OVERBURDEN 46.0 16. TOTAL CORE RECOVERY FOR SORING DEPTH DRILLED INTO ROCK 1920 TOTAL DEPTH OF HOLE 238.0 S CORE BOX OR SAMPLE CLASSIFICATION OF MATERIALS REMARKS (Delling time, states from machines, etc., if eign 80 3 16 7.5 to 230.0 + SANDSTONE, fine to coarse grained, silty, calcareous, inferred shale seams and stringers in section, soft. (logged through cuttings and E-log) visual 230.0 to 236.0[±] ident. SHALE, dark gray, arenaceous with sand seams and stringers in section, soft. (logged through cuttings and E-Log). 236.0 to 238.0 LIMESTONE, light gray; fine grained, hard(logged through cuttings and E-Log). 100 T.D.-238.0' /isua dent 120 -0: ENG FORM 1836 PREVIOUS EDITIONS ARE DESOLETE.

SASF-110 SHEET 4 of 6 SHEETS METALLATION DRILLING LOG SOUTHWESTERN PORT WORTH 11. DAYUM FOR ELEVATION SHOWN (TEM - MEG) GENERAL DYNAMICS
LOCATION (Continues of Section)
PALUXY AQUIPER INVESTIGATION
5. GRILLING AGENCY 12. MANUFACTURER'S DESIGNATION OF GRILL PAILING 1500 13. TOTAL NO. OF OVER-8A3F-110 14. TOTAL NUMBER CORE BOXES IL ELEVATION SHOUND WATER 3/13/86 M. DATE HOLE 3/18/86 MVERTICAL CINCLINED 17. ELEVATION TOP OF HOLE 7. THICKNESS OF OVERSURDEN 46.0 DEPTH DRILLED INTO ROCK 192.0 238.0 TOTAL DEPTH OF HOLE (Dylling time, water loos, westering, otc., if eight CLASSIFICATION OF MATERIALS BOX OR SAMPLE E CORE DEPTH 120 0 13<del>0.</del> visual ident. 140visual ident. 150.0 ENG FORM 18 36 PREVIOUS EDITIONS ARE OSSOLETE-

						Hel	Ma. 843F-110	_
DRILLING LOG	SOUTH	WESTERN	2020	ATION WORTH	í		OF 6 SHEETS	.]
I. PROJECY		eta 4 es 44 .				8"AUGER	FISHTAIL	1
GENERAL DYNAMI	cs		TI. BAT	OR POR EL	EVATION.	SHOOM (1884)	- HC)	7
PALUXY AQUIFE	RINVE	STIGATION	12. WAN	UPÄCTURI	IFS DESIG	SHATION OF	MILL	4
1 DRILLING AGENCY USCE			<u></u>			NG 1500	DUNDISTURBED	4
4. HOLE NO. (As shown as d	erring cities		12. TOT	AL NO. OF	LES TAKE	IN DISTURBE	0	١
S. HAME OF DRILLER		8A3F-110	14. 707	AL HUMBE	A CORE I	OXES		]
BREWER			16. ELE	VATION OF			**	]
			M. DAT	E HOLE	132	13/86	3/18/86	7
A VERTICAL MINCLI		DEG. PROM VERT		VATION TO				1
7. THICKNESS OF OVERBUR		46.0				y FOR BORING		7
6. DEPTH BRILLED INTO R	ock	192.0	19. SIGH	ATURE OF	INSPECT	OR / #	· · · · · · · · · · · · · · · · · · ·	7
9. TOTAL DEPTH OF HOLE	_	238.0	<u> </u>	1 CORE	BOX OR	Malla	REMARKS	┨
SLEVATION DEPTH LEGS	<b>**</b> O	LASSIFICATION OF MATERI		RECOV- ERY	BOX OR SAMPLE NO.	(Dritting to	e, water loos, death of	ļ
160-0	<del> !</del>				·			
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NG FORM 1836 PREV	:3							

8A3F-110 DRILLING LOG OF 6 SHEETS FISHTAIL SOUTHWESTERN PORT WORTH GENERAL DYNAMICS 10. SIZE AND TYPE OF SITE "AUGER, 35 PALUXY AQUIPER "INVESTIGATION 12. MANUFACTURER'S DEMONATION OF ORILL
FA ILING 1500
TOTAL NO. OF OVER | DESTURBED USCE IL TOTAL NO. OF OVER-8A3F-110 HAME OF DRILLER 3/18/86 3/13/86 TOVERTICAL DINCLINED IT. ELEVATION TOP OF HOLE 7. THICKNESS OF OVERSURDEN 46.0 16. TOTAL CORE RECOVERY FOR BORING L DEPTH ORILLED INTO ROCK 192.0 238.0 CLASSIFICATION OF MATERIALS RECOV 200. visual ident. 220 7 visual ident. ENG FORM 1836 PREVIOUS EDITIONS ARE DESOLETE.

### APPENDIX II

## REPORTS OF MONITOR WELL ANALYTICAL RESULTS

### RECEIVED

#### SEP 2 1 1985

BROWN AND CALDWELL ANALYTICAL LABORATORIES

MARGIS & ASSOCIATES, 1819.

LOG NO: P85-08-419

Received: 29 AUG 85 Reported: 18 SEP 85

David R. Hargis Hargis & Associates, Inc. 1735 East Fort Lowell Road, Suite 5 Tucson, Arizona 85719

Project: 250

#### REPORT OF ANALYTICAL RESULTS

LOG NO	SAMPLE DESCRIPTION, GROUND WATER SA	MPLES		DA'	TE SAMPLED
	HI4-52 HM-53 P~11M				27 AUG 85 27 AUG 85 28 AUG 85
PARAMETER			08-419-2	08-419-3	**
Bage/Neutra	al Extractables				
raction	n	09/02/85	09/02/85	09/02/85	
Date Analy	yzed	09/14/85	09/15/85		
Benzidine	, ug/L	<b>(40</b>	<b>&lt;40</b>		
Dibutylph	thalate, ug/L	<50	<b>√5</b> 0	√50	
Dimethylph	hthalate, ug/L	₹25	₹25		
N-Nitroso	di-n-propylamine, ug/L	<40	<40	<b>&lt;40</b>	
N-Nitroso	dimethylamine, ug/L	⟨80		<b>&lt;8</b> 0	
Naphthale		<10	10	-	
ûther Ba	se/Neutral Extractables,	<10	<10	<10	
Semi-Quan	tified Results **				
Total C8-	-Cl5 Aromatic Compounds, ug/L		400		

** Quantification based upon comparison of total ion count of the compound with that of the nearest internal standard.

LOG NO: P85-08-419

Received: 29 AUG 85 Reported: 18 SEP 85

David R. Hargis Hargis & Associates, Inc. 1735 East Fort Lowell Road, Suite 5 Tucson, Arizona 85719

Project: 250

LOG NO	SAMPLE	DESCRIPTION,	GROUND	WATER	SAMPLES			DA	TE S	SAMPLED
08-419-1 08-419-2 08-419-3	HM-52 HM-53 P-11M								27	AUG 85 AUG 85 AUG 85
PARAMETER	3,200					08-419-1	08-419-2	08-419-3		
Purgeable F	riority	Pollutants						**		
raction	1					09/08/85	09/08/85	09/08/85		
Acrolein,	ug/L					<b>(10</b>	· <10	<10		
Acrylonitr	ile, ug	/L				₹10	<10	<10		
Bromodichl	orometh.	ane, ug/L				2	<1	<1		
Chloroform		•				3	<1	(1		
Trichloroe		, ug/L				2	<b>(1</b>	(1		
Other Pur	geable	Priority Poll	utants,			<b>(1</b>	<b>(1</b>	(1		

Componential Componential

PAGE 2 RECEIVED: 08/29/85

Analytical Serv REPORT Results by Sample

LAB # 85-08-171

SAMPLE	SAMPLE ID P-11M			SAMPL	E # 01	FRACTION	S: A, B				
				Date	& Time	Date & Time Collected 08/28/85	08/58/8	•	Category	pro	
AS_GA	<. 002	CA E	54	CD_E <. 002 CL_IC_	(, 002 ug/m1	01 TO	18 mg/L	18 CO3 A (1,0 CR E mg/L as caco3	(1.0 cac03	S	₹. 005
CUE	K. 001	ਜ਼ ਜ਼	0.028* ug/m1	HCO3 A 263	263 Cacco	HG_CA < . 0002 K E	€. 0002 ug/m1	X E	5.6 MG E	<b>1</b>	20 - 20
NA E	57 ug/m1	PB GA	(, 002 ug/m1	SE_GA	(, 005 ug/m1	K. 005 S04 IC	48 mg/L	48 SR_E	3.5 ug/m1		

#### **RECEIVED**

SEP 1 4 1985

HARGIS & ASSOCIATES, INC.



ANALYTICAL LABORATORIES

LOG NO: P85-09-090

Received: 07 SEP 85 Reported: 12 SEP 85

David R. Hargis Hargis & Associates, Inc. 1735 East Fort Lowell Road, Suite 5 Tucson, Arizona 85719

Project: 250

#### REPORT OF ANALYTICAL RESULTS

LOG NO	SAMPLE DESCRIPTION, AQUEOUS SAMPLES			DA	TE SAMPLED
09-090-1 09-090-2 09-090-3	P-11(M)) P-11(U) HM-84				05 SEP 85 05 SEP 85 05 SEP 85
PARAMETER		09-090-1	09-090-2	09-090-3	
P 'eable	Priority Pollutants		********		
Lcractio	n	09/11/85	09/11/85	09/11/85	
Acrolein,	ug/L	<10	<10	<10	
Acrylonit	rile, ug/L	<10	<10	<10	
Methylene	Chloride, ug/L	<1	15	3	
Toluene,	ug/L	<1	64	(1	
Other Pu	rgeable Priority Pollutants,	<1	<1	<1	

Edward Wilson, Laboratory Director

#### HARAIS & ASSOCIATES, INC.

**ANALYTICAL LABORATORIES** 

LOG NO: P85-10-231

Received: 14 OCT 85 Reported: 01 NOV 85

Peter Quinlan Hargis & Associates, Inc. 2223 Avenida de la Playa Suite 300 La Jolla, CA 92037

Project: 250

LOG NO	SAMPLE DESCRIPTION	, GROUND W	ater sample	S	· DA	TE SAMPLED
10-231-2 10-231-3 10-231-4	P-11U P-11M P-12 <b>M</b> HM-36 HM-37					10 OCT 85 10 OCT 85 10 OCT 85 11 OCT 85 10 OCT 85
PARAMETER		10-231-1	10-231-2	10-231-3	10-231-4	10-231-5
Purgeable Pr	iority Pollutants					
Extraction		10/24/85	10/24/85	10/25/85	10/23/85	10/25/85
Acrolein, u	g/L	<10	<10	<10	<10	<100
Acrylonitri		<10	<10	<10	<10	<100
	hylene, ug/L	<1	<1	<1	1	340
Toluene, ug		70	<1	<1	<1	<10
	ichloroethylene, u	g/L <1	<1	<1	<1	<del>9</del> 0
	eable Priority	<b>(1</b>	<b>(1</b>	<1	<1	<10

LOG NO: P85-12-201

Received: 13 DEC 85 Reported: 03 JAN 86

Peter T. Quinlan Hargis & Associates, Inc. 2223 Avenida de la Playa Suite 300 La Jolla, CA 92037

Project: 250

LOG NO	SAMPLE DESCRIPTION , GROUND WATER S	SAMPLES	DA:	TE SAMPLED
	P-12U French Drain #1 Drain Pipe			12 DEC 85 11 DEC 85 11 DEC 85
PARAMETER		12-201-2	12-201-3	
Extraction Date Analy 1,2-Dichlo 1,4-Dichlo 2,4-Dimeth 2,4-Dinity 2-Methylo 4-Nitropho Benzidine Dibutylpho Dimethylph N-Nitrosoo N-Nitrosoo Naphthale	yzed orobenzene, ug/L orobenzene, ug/L hylphenol, ug/L rophenol, ug/L 4,6-dintrophenol, ug/L enol, ug/L thalate, ug/L hthalate, ug/L di-n-propylamine, ug/L dimethylamine, ug/L	12/16/85 12/19/85 <10 <10 <25 <50 <25 <40 <50 <25 <40 <10	67	12/16/85 12/20/85 130 18 10 <25 <50 <25 <40 <50 <25 <40 <10
A Terpend Total C8- Total Un:	tified Results ** ol, ug/L -C35 Hydrocarbons, ug/L identified Compounds, ug/L hyl Butyl Phenol, ug/L		 60 10	20 10,000 

^{**} Quantification based upon comparison of total ion count of the compound with that of the nearest internal standard.

LOG NO: P85-12-201

Received: 13 DEC 85 Reported: 03 JAN 86

Peter T. Quinlan Hargis & Associates, Inc. 2223 Avenida de la Playa Suite 300 La Jolla, CA 92037

Project: 250

#### REPORT OF ANALYTICAL RESULTS

LOG NO	SAMPLE DESCRIPTION , GROUND WATER S	AMPLES	DA	TE SAMPLED
	P-12U French Drain #1 Drain Pipe			12 DEC 85 11 DEC 85 11 DEC 85
PARAMETER		12-201-2	12-201-3	12-201-4
Extraction 1,1,1-Tric 1,1-Dichlo Acrolein, Acrylonite Benzene, u Chlorobenz Ethylbenze Tetrachlor Trichloroe Toluene, u Vinyl Chlo trans-1,2-	chloroethane, ug/L proethylene, ug/L ug/L rile, ug/L ug/L ug/L ene, ug/L ene, ug/L coethylene, ug/L ethylene, ug/L	12/21/85 <1 <10 <10 <1 <1 <1 <1 <1 <1 <1 <1 <1 <1 <1 <1 <1	12/20/85 23 15 <100 <100 <10 27 66 83 1000 250 2800 7500 <10	250 25 40 25 180 1200 950 11,000
	ified Results ** somers, ug/L		45.40.40	100

** Quantification based upon comparison of total ion count of the compound with that of the nearest internal standard.

LOG NO: P85-12-201

Received: 13 DEC 85 Reported: 03 JAN 86

Peter T. Quinlan Hargıs & Associates, Inc. 2223 Avenida de la Playa Suite 300 La Jolla, CA 92037

Project: 250

LOG NO	SAMPLE DESCRIPTION ,	GROUND H	IATER	SAMPLE	S	ם	ATE SAMPLED
12-201-2 12-201-3 12-201-4	P-12U French Drain #1 Drain Pipe						12 DEC 85 11 DEC 85 11 DEC 85
PARAMETER					12-201-2	12-201-3	12-201-4
Total Fuel Oil and Gre	Hydrocarbons, mg/L ase, mg/L				(1 32	(1 14	4 120

# CORPORATION

PAGE 3 RECEIVED: 12/16/85

Analytical Serv Results by Sample

LAB # 85-12-073

C; A	Date & Time Collected 12/12/85 Category	0.48 CU E < .001 FE E 5.0   ug/m1	0.39 m1m/gu
FRACTION	Collected	CR_E	SR_E
PLE # 04	e & Time	(, 002 CR E	0.010*
SAF	Dat	CD E	SE_GA_
		0.003*	0.004*
		AS_GA	PB_GA
SAMPLE 10 HM-85		<. 002 ug/m1	<. 0002
SAMPLE		AG_E	HG_CA

SAMPLE	SAMPLE ID P-12U			SAMPL	E # 05	<b>FRACTION</b>	S: A, B				
				Date	& Time	Date & Time Collected 12/12/85	12/12/8	5	Category	ory	
AG E	<. 004 AS GA ug/m1	AS_GA	0.024 ug/m1	CA E	540 ug/m1	540 CD E <. 002 CL IC	<. 002	21 TO	16 mg/L	16 CO3 A (1 mg/L as CaCO3	Cacos
CR_E	0.18 ug/m1	CU E	0.093	<u> </u>	77 ug/m1		HCO3 A 174 HG CA mg/L as Caco3	HG_CA	<. 0002 K E ∪ 09/m1	¥	15 July 123
9 E	38 ug/m1	NA E	44 ug/m1	PB_GA	0, 10 ug/ml	0, 10 SE GA 0, 016* 504 IC	0.016* ug/ml	504_IC	7/6w	45 SR E	4.3

LOG NO: P86-01-154

Received: 10 JAN 86 Reported: 23 JAN 86

Peter T Quinlan Hargis & Associates, Inc. 2223 Avenida de la Playa Suite 300 La Jolla, CA 92037

Project: 250

LOG NO	SAMPLE DESCRIPTION	ON , GROUND W	ater sample	S	DA	TE SAMPLED
	P-10 Upper P-10 Middle P-11 Upper P-11 Middle P-12 Middle					08 JAN 86 08 JAN 86 09 JAN 86 09 JAN 86 09 JAN 86
PARAMETER		01-154-11	01-154-12	01-154-13	01-154-14	01-154-15
Extraction Acrolein, Acrylonita trans-1,2-	ug/L rile, ug/L -Dichloroethylene, rgeable Priority	01/13/86 <10 <10	01/13/86 <10 <10 <1 <1	01/13/86 <10 <10 <1 <1	01/13/86 <10 <10 <1 <1	01/14/86 <10 <10 <1 <1

LOG NO: P86-01-154

Received: 10 JAN 86 Reported: 23 JAN 86

Peter T Quinlan Hargıs & Associates, Inc. 2223 Avenida de la Playa Suite 300 La Jolla, CA 92037

Project: 250

LOG NO	SAMPLE DESCRIPTION , GROUND WATE	R SAMPLES	DATE SAMPLED
01-154-24	P-12 Upper		09 JAN 86
PARAMETER		01-154-24	
Oil and Gre		9	
Total Fuel	Hydrocarbons, mg/L	<b>(1</b>	
Purgeable P	riority Pollutants		
Extraction	l	01/14/86	
1,1,1-Tric	hloroethane, ug/L	62	
Acrolein,	ug/L	<10	
Acrylonita	ile, ug/L	<10	
	geable Priority Pollutants,	<1	
	Priority Pollutants		
Extraction		ù1/13/8 <del>6</del>	
Date Analy	zed	Ul/16/86	
	ophenol, ug/L	₹25	
	, 6-dintrophenol, ug/L	₹50	
4-Nitrophe		₹25	
Benzidine,	ug/L	₹40	
Dibutylpht	chalate, ug/L	₹50	
	thalate, ug/L	<b>√2</b> 5	
N-Nitrosod	i-n-propylamine, ug/L	₹40	
	imethylamine, ug/L	<b>&lt;8</b> 0	
	,A Ext. Priority Pollutants,	<10	

# E PERMINE

PAGE 3 RECEIVED: 01/13/86

Analytical Serv REPORT Results by Sample

LAB # 86-01-044

SAMPLE	SAMPLE ID P-12 upper	00er		SAMPL	E # 05	FRACTIONS	3. A. B				
				Date	& Time	Date & Time Collected 01/09/86	01/09/8	.0	Category	org	
AG E	0.005* A	AS_GA	<. 003	CA E	41	41 CD E C. 002 CL IC	<. 002	21 73		11 CO3 A <1	
	ug/m]		ug/m]		ug/m]		lm/go		A9 /L	# 7/6#	s cacus
ш Ж	0.006* C	CU E	0.012	FI T	1.6	1.6 HC03 A 225	225	HG CA	HG CA (.0002 K E	X M	6.5
1	ug/ml	í	ug/m1		ug/m1	mg/L as	caco3		ug/m1		UG/#1
ш <u>2</u>	13	13 ME	0.076	NA E	44 N	NO3 IC <. 2 PB GA 0.007*	ر د	PB GA	0.007*	SE GA	₹. 003
	ug/ml		1m/6n		lm/gu		J/Bm		ug/ml		ug/m1
1 S04 IC	47	47 SR E	2.6	ZN E	1.5						
	mg/L		ug/ml		ug/ml						

LOG NO: P86-04-079

Received: 04 APR 86 Reported: 22 APR 86

David R. Hargis Hargis & Associates, Inc. 2223 Avenida de la Playa Suite 300 La Jolla, CA 92037

Project: 250

LOG NO	SAMPLE DESCRIPTION	, GROUND W	ATER SAMPLE	S	DA	TE SAMPLED
04-079-27	P-9 Middle P-10 Upper P-10 Middle P-11 Middle French Drain #1					02 APR 86 03 APR 86 03 APR 86 02 APR 86 03 APR 86
PARAMETER		04-079-24	04-079-25	04-079-26	04-079-27	04-079-28
Purgeable F	Priority Pollutants				,	
Extraction	l	04/14/86	04/14/86	04/14/86	04/14/86	4/15/86
1,1,1-Tric	hloroethane, ug/L	<1	(1	<b>&lt;1</b>	<1	89
Acrolein,	ug/L	<10	<10	<10	<10	₹500
Acrylonitr	ile, ug/L	<10	<10	<10	<10	<500
Chloroform	ı, ug/L	(1	(1	<1	<1	59
Tetrachlor	oethylene, ug/L	<1	<1	<1	<1	210
Trichloroe	thylene, ug/L	<b>(1</b>	a	<b>&lt;1</b>	<b>&lt;1</b>	4200
Vinyl Chlo	ride, ug/L	<1	(1	<b>(1</b>	(1	1300
trans-1,2-	Dichloroethylene, u	g/L <1	4	(1	(1	24,000
Other Pur Pollutant	geable Priority	(1	(1	<1	<1	< 50

LOG NO: P86-04-128

Received: 08 APR 86 Reported: 25 APR 86

Peter T Quinlan Hargis & Associates, Inc. 2223 Avenida de la Playa Suite 300 La Jolla, CA 92037

Project: 250

LOG NO	SAMPLE DESCRIPTION	, GROUND W	NATER SAMPLE	S.	DA	TE SAMPLED
04-128-37	HM-92					07 APR 86
04-128-38	P-2					05 APR 86
04-128-39	P-3					06 APR 86
04-128-40	P-11 Upper					05 APR 86
04-128-41	P-12 Upper					06 APR 86
PARAMETER		04-128-37	04-128-38	04-128-39	04-128-40	04-128-41
•	Priority Pollutants					
Extraction	1	4/17/86	4/17/86	4/17/86	4/18/86	4/18/86
1,1,1-Tric	chloroethane, ug/L	<1	<1	<1	<1	56
Acrolein,		<10	<10	<10	<10	<10
Acrylonit	_	<10	<10	<10	<10	<10
Chloroform		2	<b>&lt;1</b>	2	<1	⟨1
Toluene, u		2	<b>(1</b>	8	(1	<1
	geable Priority	(1	(1	<1	(1	<1
Pollutant	18,					

LOG NO: P86-04-128

Received: 08 APR 86 Rep rted: 25 APR 86

Peter T Quinlan Hargis & Associates, Inc. 2223 Avenida de la Playa Suite 300 La Jolla, CA 92037

Project: 250

### REPORT OF ANALYTICAL RESULTS

LOG NO	SAMPLE DESCRIPTION , GROUND WATER	SAMPLES	D#	TE SAMPLED
04-128-42 04-128-43 04-128-44	P-12 Middle Cooling Tower Influent Cooling Tower Effluent			06 APR 86 06 APR 86 06 APR 86
PARAMETER		04-128-42	04-128-43	04-128-44
Purgeable P	riority Pollutants	~		
Extraction		4/18/86	4/18/86	<ul><li>4/18/86</li></ul>
1,1,1-Tric	hloroethane, ug/L	. (1	51	3
1,1-Dichlo	roethylene, ug/L	. (1	14	<1
Acrolein,	ug/L	<10	<100	<10
Acrylonitr	ile, ug/L	(10	<100	<10
Chloroform	, ug/L	<b>(1</b>	12	<1
Tetrachlor	oethylene, ug/L	(1	29	2
	thylene, ug/L	<1	1800	94
Vinyl Chlor	ride, ug/L	(1	150	<1
trans-1,2-1	Dichloroethylene, ug/L	(1	3000	150
	geable Priority Pollutants,	(1	<10	<1

Edward Wilson, Laboratory Director

LOG NO: P86-04-220

Received: 10 APR 86 Reported: 15 MAY 86

Sam Williams Hargis & Associates, Inc. 2223 Avenida de la Playa Suite 300 La Jolla, CA 92037

Project: 250

LOG NO	SAMPLE DESCRIPTION , GROUND WAT	ER SAMPLES	DATE SAMPLED
04-220-6	P-13 Upper		09 APR 86
PARAMETER		04-220-6	
Oil and Great Alkalinity	ase, mg/L	<5	
Carbonate A	Alk (as CaCO3), mg/L	40	
Bicarb Alk	(as CaCO3), mg/L	210	
Hydroxide i	Alk (as CaCO3), mg/L	0	
Other Alk	alinity,	<10	
Total Fuel !	Hydrocarbons, mg/L	<b>(1</b>	
	riority Pollutants		
Extraction	<b>▼</b>	04/20/86	
Acrolein,	ug/L	<10	
Acrylonitr:		<10	
	geable Priority Pollutants,	(1	

LOG NO: P86-04-220

Received: 10 APR 86 Reported: 15 MAY 86

Sam Williams Hargis & Associates, Inc. 2223 Avenida de la Playa Suite 300 La Jolla, CA 92037

Project: 250

LOG NO	SAMPLE DESCRIPTION , GROUND WATER	R SAMPLES	DATE SAMPLED
04-220-6	P-13 Upper		09 APR 86
PARAMETER		04-220-6	
B/N,A Ext.	Priority Pollutants		
Extraction	ı	4/14/86	
Date Analy	zed	4/17/86	
2,4-Dinitr	ophenol, ug/L	<25	
Z-Methyl-4	,6-dintrophenol, ug/L	<50	
4-Nitrophe	nol, ug/L	₹25	
Benzidine,	ug/L	. <40	
Dibutylpht	halate, ug/L	<50	
Dimethylph	thalate, ug/L	⟨25	
N-Nitrosod	i-n-propylamine, ug/L	<b>&lt;40</b>	
N-Nitrosod	imethylamine, ug/L	<80	
Other B/N	,A Ext. Priority Pollutants,	<10	

LOG NO: PB6-04-220

Received: 10 APR 86 Reported: 15 MAY 86

Sam Williams Hargis & Associates, Inc. 2223 Avenida de la Playa Suite 300 La Jolla, CA 92037

Project: 250

LOG NO SAMPLE DESCRIPTION , GROUND WATER SAMPLES	DATE SAMPLED
04-220-6 P-13 Upper	OSS NOTE: RIG
	1-220-6
Magnesium, mg/L	<0.067
Copper, mg/L	<0.02
Iron, mg/L	<0.2
Manganese, mg/L	<0.01
Potassium, mg/L	20
Sodium, mg/L	· <b>81</b>
Zinc, mg/L	0.21
·	0.0075
	<0.009
	0.0005
	0.0056
Strontium, mg/L	2.9
Chromium, mg/L	<0.03
Lead, mg/L	0.038
	/29/86
Calcium (EDTA Titration), mg/L	170
Chloride, mg/L	240
Surfactants, mg/L	<0.1
pH, Units	11.5
Sulfate, mg/L	26
Specific Conductance, umhos/cm	1600
Filterable Residue (TDS), mg/L	720
Nitrate (as NO3), mg/L	<4 

LOG NO: P86-05-179

Received: 09 MAY 86 Reported: 10 JUN 86

Peter Quinlan Hargis & Associates, Inc. 2223 Avenida de la Playa Suite 300 La Jolla, CA 92037

Project: 250

DATE SAMPLED	
08 MAY 86	
••	
•	
•	

4100 PIERCE RD., BAKERSFIELD, CALIFORNIA 93308 PHONE 327-4911

Hargis & Associates, Inc. 2223 Avenue De La Playa, Suite 300

Date Reported: 6/12/86 Date Received: 5/9/86

La Jolla, California 92037

Laboratory No.: 7140

Attention: Alan Wylie

Job #250

WATER ANALYSIS

Sample Description: 5/7/86 Well P-12 Upper 20:20

Constituents	mg/liter
Iron Manganese Arsenic Copper Zinc Barium Cadmium Total Chromium Lead Mercury Selenium Silver Antimony Beryllium Nickel	0.13 9.06 (-) 0.01 (-) 0.01 0.41 (-) 0.5 (-) 0.005 (-) 0.01 (-) 0.002 (-) 0.005 (-) 0.01 (-) 1.0 (-) 0.01 (-) 0.01 (-) 0.01 (-) 0.05
Thallium Molybdenum Strontium	(-) 0.5 (-) 0.1 1.6

(-) refers to "less than"

B C LABORATORIES, INC.

RECEIVED

JUN 1 3 '86

HARGIS + ASSOCIATES, INC. LA JOLLA, CA

PETROLEUM

## I ABORATORIES, INC.

J. J. EGLIN, REG. CHEM. ENGR.

4100 PIERCE RD., BAKERSFIELD, CALIFORNIA 93308 PHONE 327-4911

Hargis & Associates, Inc.

1735 East Fort Lowell Road, Suite 5

Tucson, Arizona 85719

Date Reported: 6/12/86 Date Received: 5/9/86 Laboratory No.: 7141

Attention: Alan Wylie Job # 250

WATER ANALYSIS

Sample Description: 5/7/86 Well P-13 Upper 18:40

Constituents Hydroxide	epm 3.28	mg/liter 45.9
Calcium	6.00	120.
Magnesium	0.00	0.03
Sodium	3.39	78.
Potassium	0.54	21.
Carbonate	1.45	43.4
Bicarbonate	0.	0.
Chloride	4.12	146.
Sulfate	1.06	51.
Nitrate	(-) 0.01	0.4
Fluoride	( ) 0.01	0.55
Iron .		0.64
Manganese	٠.	. 0.06
Arsenic		(-) 0.01
Copper	·	0.14
Zinc		4.4
Total Dissolved Solids @ 180°C		710.
Barium		(-) 0.5
Cadmium		(-) 0.005
Total Chromium		(-) 0.01
Lead		0.17
Mercury		(-) 0.0002
Selenium		(-) 0.005
Silver		(-) 0.01
Boron		(-) 0.10
Silica		18.
Antimony		(-) 1.0
Beryllium		(-) 0.01
Nicke!		(-) 0.05
Thallium		(-) 0.5
Molybdenum		(-) 0.1
Strontium		1.1

PH Electrical Conductivity, Micromhos/cm

(-) refers to "less than"

B C LABORATORIES, INC.

BY 5. J. Eglin

11.1 1,550.

RECEIVED

JUN 1 3 '86

HARGIS + ASSOCIATES, INC. LA JOLLA, CA

CORPORATION

Uark Order # 85-05-094 Austin Results by Sample Res Page a Received: 05/09/86

FE E       0.17         SAMPLE # 02 FRACTIONS: A         SAMPLE # 02 FRACTIONS: A         FE E       9.9         SAMPLE # 03 FRACTIONS: A         SAMPLE # 03 FRACTIONS: A         FE E       4.5         FE E       4.5
SAMPLE ID HM-85 Catenory

3.6

LOG NO: P86-06-142

Received: 09 JUN 86 Reported: 07 JUL 86

Peter Quinlan Hargis & Associates, Inc. 2223 Avenida de la Playa Suite 300 La Jolla, CA 92037

Project: 250

LOG NO	SAMPLE DESCRIPTION , GROUND	WATER SAMPLE	:S	DA	TE SAMPLED
06-142-18	HM-21 HM-30 HM-53 P-13 Upper				05 JUN 86 04 JUN 86 04 JUN 86 05 JUN 86
APAMETER	•	06-142-16	06-142-17	06-142-18	06-142-19
Oil and Gre	•		<5	(5	√5
Total Fuel	Hydrocarbons, mg/L Priority Pollutants		(1	2	<1
Extraction	•				06/11/86
Date Analy	zed				06/13/86
2,4-Dinitr	ophenol, ug/L				₹25
2-Methy1-4	,6-dintrophenol, ug/L				€50
4-Nitrophe	nol, ug/L				₹ 25
Benzidine,	-				440
Dibutylpht	halate, ug/L				<50
Dimethylph	thalate, ug/L				₹25
N-Nitrosod	i-n-propylamine, ug/L				(40
N-Nitrosod	imethylamine, ug/L				₹80
Other B/N	,A Ext. Priority Pollutants,				<10

LOG NO: P86-06-142

Received: 09 JUN 86 Reported: 07 JUL 86

Peter Quinlan Hargis & Associates, Inc. 2223 Avenida de la Playa Suite 300 La Jolla, CA 92037

Project: 250

### REPORT OF ANALYTICAL RESULTS

LOG NO	SAMPLE DESCRIPTION , GROUND WATER SAMPLES			DATE SAMPLED	
06-142-16	HM-21				05 JUN 86
06-142-17	HM-30				04 JUN 86
06-142-18	HM-53				04 JUN 86
06-142-19	P-13 Upper				05 JUN 86
PARAMETER		06-142-16	06-142-17	06-142-18	06-142-19
Purgeable F	Priority Pollutants				
Extraction	1	06/14/86			06/14/86
Acrolein,	ug/L	< 500			<10
Acrylonitr	rile, ug/L	<500			<10
trans-1,2-	Dichloroethylene, ug/L	3850			<1
Other Pur	rgeable Priority Pollutants,	<50			$\alpha$

Edward Wilson, Laboratory Director

PETROLEUM .

# _ABORATORIES, INC.

J. J. EGLIN, REG. CHEM. ENGR.

4100 PIERCE RD., BAKERSFIELD, CALIFORNIA 93308 PHONE 327-4911

Hargis & Associates

1735 East Fort Lowell Road, Suite 5

Tucson, Arizona 85719 Attention: Sam Williams Date Reported: 7/1/86 Date Received: 6/9/86

Laboratory No.: 8934

Job 250

### WATER ANALYSIS

Sample Description: General Dynamics #250 6/5/86 P-13 Upper SW/CR 16:00

Constituents	epm	mg/liter
Hydroxide	3.46	58.8
Calcium	4.40	88.
Magnesium	0.01	0.08
Sodium	3.00	69.
Potassium	0.38	15.
Carbonate	1.02	30.7
Bicarbonate	0.	0.
Chlo <i>c</i> ide	2.01	71.1
Sulfate	1.40	67.
Nitrate	(4) 0.01	( <b>4</b> ) 0.4
Fluoride		0.44
Iron		0.16
Manganese		0.01
Arsenic	•	(4) 0.01
Copper		0.02
Zinc		1.4
Total Dissolved Solids	@ 180°C	490.
Barium		( <b>4</b> ) 0.5
Cadmium		(4) 0.005
Total Chromium		(4) 0.01
Lead		0.06
Mercury		(4) 0.0002
Selenium		(4) 0.005
Silver		(4) 0.01
Boron		( <b>4</b> ) 0.10
Silica		22.
Antimony		(4) 1.0
Beryllium		(4) 0.01
Nickel		(4) 0.05
Thallium		( <b>4</b> ) 0.5
Molybdenum		(4) 0.1
Strontium		0.9
Electrical Conductivity	·,	
Micromhos/cm @ 25 °C		730.
рH		10.8
-		

B C LABORATORIES, INC.

BY L. J. Glid

LOG NO: P86-07-212

Received: 11 JUL 86 Reported: 29 JUL 86

Peter Quinlan Hargis & Associates, Inc. 2223 Avenida de la Playa Suite 300 La Jolla, CA 92037

Project: 250

LOG NO	SAMPLE DESCRIPTION	, GROUND N	ATER SAMPLE	S	DA	TE SAMPLED
07-212-20 07-212-21 07-212-22 07-212-23 07-212-24	P-9 Upper P-9 Middle P-11 Upper P-11 Middle P-12 Upper					10 JUL 86 10 JUL 86 10 JUL 86 10 JUL 86 09 JUL 86
PARAMETER		07-212-20	07-212-21	07-212-22	07-212-23	07-212-24
Extraction 1,1,1-Tric Acrolein, Acryloniti	chloroethane, ug/L ug/L rile, ug/L rgeable Priority	07/21/86 (1 (10 (10	07/22/86 <1 <10 <10 <1	07/22/86 <1 <10 <10 <1	07/22/86 <1 <10 <10 <10	07/22/86 7 <10 <10 <1

LOG NO: P86-07-212

Received: 11 JUL 86 Reported: 29 JUL 86

Peter Quinlan Hargis & Associates, Inc. 2223 Avenida de la Playa Suite 300 La Jolla, CA 92037

Project: 250

LOG NO SAMPL	SAMPLE DESCRIPTION , GROUND WATER SAMPLES					DATE SAMPLED	
07-212-25 P-12 07-212-26 P-13 07-212-27 P-41 07-212-28 P-48 07-212-29 P-60	Middle Upper					09 JUL 86 09 JUL 86 09 JUL 86 09 JUL 86 09 JUL 86	
PARAMETER	· 07-2]	12-25	07-212-26	07-212-27	07-212-28	07-212-29	
Purgeable Priorit Extraction 1,1,1-Trichloroe 1,1,2,2-Tetrachl 1,1-Dichloroetha 1,1-Dichloroetha 1,3-Dichloroprop Acrolein, ug/L Acrylonitrile, u Bromodichloromet Benzene, ug/L Chloroform, ug/L Ethylbenzene, ug Trichloroethylen Toluene, ug/L trans-1,2-Dichlo trans-1,3-Dichlo Other Purgeable	thane, ug/L oroethane, ug/L ne, ug/L lene, ug/L ne, ug/L ene, ug/L ene, ug/L  /L e, ug/L roethylene, ug/L ropropene, ug/L	22/86 5 (1 2 (1 (1) (1) (1) (1) (1) (1) (1) (1) (1)	07/22/86 (1 (1 (1 (1 (1) (1) (1) (1) (1) (1) (1 (1) (1)	07/23/86 51 20 <10 17 17 15 <100 <100 21 33 <10 14 930 16 1400 19 <10	07/22/86 30 <10 <10 <10 <10 <100 <100 <100 <100	07/22/86 20 <10 <10 17 <10 <100 <100 <100 <100 <10	

LOG NO: P86-08-106

Received: 07 AUG 86 Reported: 28 AUG 86

Sam Williams
Hargis & Associates, Inc.
2223 Avenida de la Playa Suite 300
La Jolla, CA 92037

Project: 250

Page 4

LOG NO SAMPLE DESCRIPTION	, GROUND WA	ATER SAMPLES	5	D/	TE SAMPLED
08-106-16 Radar Range Seep 08-106-17 C-3 08-106-18 C-5 08-106-19 HM-21 08-106-20 P-13M					06 AUG 86 06 AUG 86 06 AUG 86 06 AUG 86 06 AUG 86
PARAMETER	08-106-16	08-106-17	08-106-18	08-106-19	08-106-20
Oil and Grease, mg/L Total Fuel Hydrocarbons, mg/L B/N,A Ext. Priority Pollutants	•••	<b>&lt;</b> 5	<5		<5 <1
Extraction			***		08/14/86
Date Analyzed 2,4-Dinitrophenol, ug/L	•		***		08/25/86 <b>&lt;</b> 25
2-Methyl-4,6-dintrophenol. us/	L			•••	<b>&lt;5</b> 0
4-Nitrophenol, ug/L Benzidine, ug/L			***		<25 <40
Dibutylphthalate, ug/L	•••		•••	•••	<b>&lt;</b> 50
Dimethylphthalate, ug/L N-Nitrosodi-n-propylamine, ug/	1	•••	• • •	•••	<b>&lt;25</b> <b>&lt;4</b> 0
N-Nitrosodimethylamine, ug/L		•••	•••	•••	<b>&lt;8</b> 0
Other B/N, A Ext. Priority Pol	lutants	• • •		•••	<10

LOG NO: P86-08-106

Received: 07 AUG 86 Reported: 28 AUG 86

Sam Williams Hargis & Associates, Inc. 2223 Avenida de la Playa Suite 300 La Jolla, CA 92037

Project: 250

	REP	ORT OF ANAL	YTICAL RESU	JLTS		Page 6
LOG NO	SAMPLE DESCRIPTION	, GROUND WA	TER SAMPLES	5	DA	ATE SAMPLED
08-106-19	Radar Range Seep C-3 C-5 HM-21 P-13M					06 AUG 86 06 AUG 86 06 AUG 86 06 AUG 86 06 AUG 86
PARAMETER		08-106-16	08-106-17	08-106-18	<b>08-106-19</b>	08-106-20
Extraction Acrolein, Acrylonitr Toluene, u trans-1,2-	ug/L ile, ug/L		08/16/86 <10 <10 <1 <1 <1	08/16/86 <10 <10 150 <1 <1	08/16/86 <250 <250 <25 4400 <25	08/16/86 <10 <10 <1 <1 <1

Edward Wilson, Laboratory Director

# DATE ILMED